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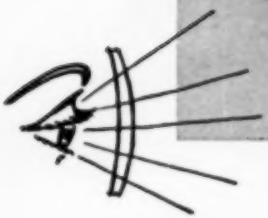

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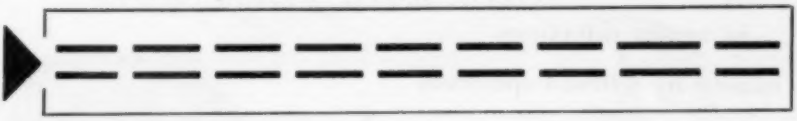

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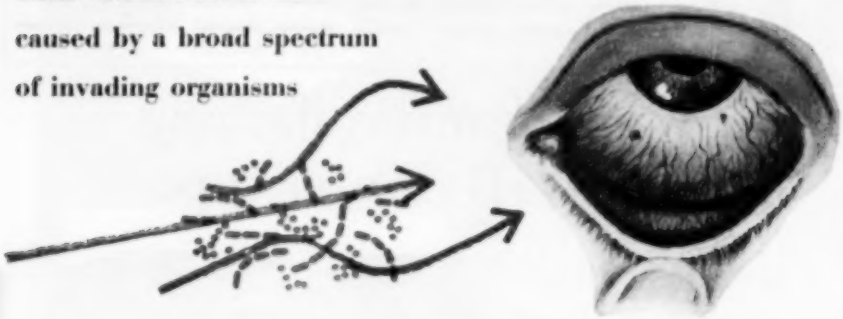

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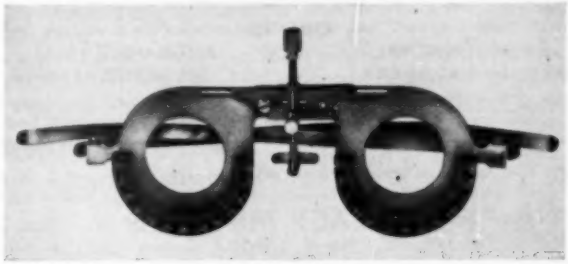

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Anatomy, embryology, and comparative ophthalmology; General pathology, bacteriology, immunology; Vegetative physiology, biochemistry, pharmacology, toxicology; Physiologic optics, refraction, color vision; Diagnosis and therapy; Ocular motility; Conjunctiva, cornea, sclera; Uvea, sympathetic disease, aqueous; Glaucoma and ocular tension; Crystalline lens; Retina and vitreous; Optic nerve and chiasm 1938

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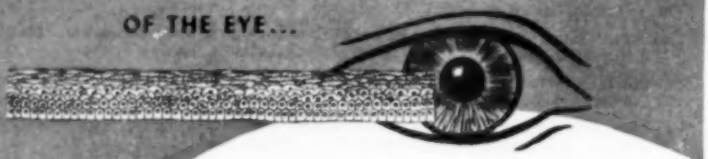

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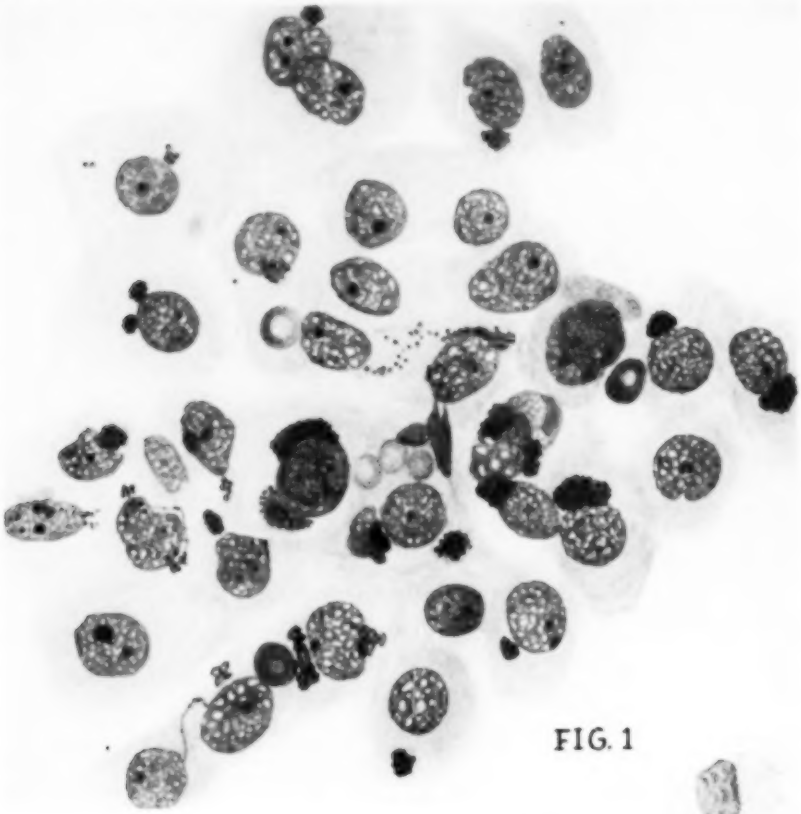

FIG. 1

FIG. 2

FIG. 3

FIG. 4

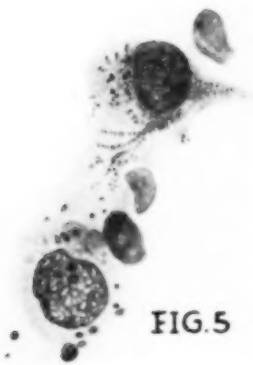

FIG. 5

SEE OPPOSITE PAGE FOR DESCRIPTION

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 33 DECEMBER, 1950 NUMBER 12

THE NATURE OF INCLUSION BODIES IN TRACHOMA*

HENRY GROSSFELD,† M.D.
New York

1. EARLY DIAGNOSIS AND EPIDEMIOLOGY OF TRACHOMA

The Prowazek-Halberstaedter inclusion bodies in the epithelial cells of the conjunctiva are specific for trachoma. Although their occurrence in inclusion blennorrhea and in bath conjunctivitis ought to be taken into account for differential diagnosis, it does not impair to any extent their diagnostic value in trachoma.

As a matter of fact, however, little or no diagnostic use is made of the finding of inclusion bodies because they are usually absent in most cases of clinically doubtful trachoma, while, in other positive cases, many hours are needed for detecting one or two inclusion bodies in an entire preparation.

It is necessary to assume that inclusion bodies, as the agent of trachoma, must appear in the epithelial cells of the conjunctiva earlier than follicles are formed in the subepithelial tissue, since the formation of follicles is the result of the presence of the virus in the epithelial cells.

In fact, I have stated—and my views are in accordance with those of other authors—that, between the appearance of inclusion bodies in the epithelial cells and the formation of typical follicles, several days to several weeks must pass. It is just at this stage, when the diagnosis of trachoma is not yet clinically possible, that inclusion bodies are, as a rule, found in abundance in the epithelial cells of scrapings of the conjunctiva and that the microscopic diagnosis is, therefore, very easy.

Thus it would seem that, by the time a clinical diagnosis is possible, the period for microscopic diagnosis is passed.

This period of "acute conjunctivitis" during which inclusion bodies are in the scrapings of the conjunctiva, has been found to have the foremost import from a diagnostic, as well as from an epidemiologic, aspect. It has been named the prefollicular stage of trachoma.

In Chart 1 is illustrated the course of trachoma in respect to the relationship between

* Part of this work was done during World War II at the Trachoma Institute, Ufa (Baskiria).

† Fellow of the United Nations World Health Organization.

Figs. 1 to 5 (Grossfeld). Nature of inclusion bodies in trachoma. (Fig. 1) Prefollicular stage of trachoma. Prowazek-Halberstaedter inclusion bodies are in almost every epithelial cell. The clinical diagnosis was acute conjunctivitis. (Fig. 2) Positive Feulgen reaction of elementary bodies of the virus of trachoma in the cytoplasm of epithelial cells. (Fig. 3) Two Leber's cells with divers particles usually described as free initial bodies. From a nontrachomatous acute conjunctivitis. (Fig. 4) Positive Feulgen reaction of elementary bodies of the virus of trachoma in the cytoplasm of epithelial cells. The same scrapings were previously Giemsa stained and the typical Prowazek-Halberstaedter's inclusion bodies in the cells could be seen where the Feulgen-positive particles now are. (Fig. 5) An epithelial cell containing scattered elementary bodies of trachoma. Opposite to it is a Leber's epithelioid cell with divers particles usually described as free initial bodies. From scrapings of a conjunctiva showing trachoma prefolliculare.

microscopic findings and clinical diagnosis. In Figure 1 we see the abundance of inclusion bodies found in scrapings of the conjunctiva taken during the prefollicular stage of trachoma when the clinical diagnosis was "acute conjunctivitis."

It is now possible to explain the epidemiologic paradox—how, on the one hand, trachoma is considered only slightly contagious, and, on the other hand, the fact that it must be extremely contagious as evidenced by its widespread and rapid propagation—since it can be shown that trachoma is contagious mainly in its prefollicular stage.

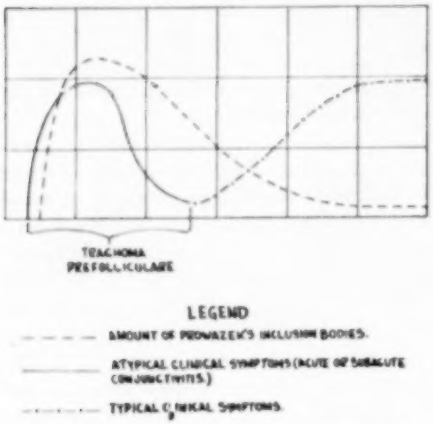

Chart 1 (Grossfeld). The course of trachoma in respect to the relationship between microscopic findings and clinical diagnosis.

Why inclusion bodies disappear promptly in the later chronic stages of trachoma is not yet clear. We may, however, find some analogies in many other virus diseases. For example, in lymphogranuloma inguinale, the inclusion bodies in the leukocytes may be observed only in the first 10 to 12 days; thereafter, they disappear altogether while the clinical symptoms continue and grow worse. The disease may, however, be produced by inoculation with material taken at this later stage. Although this material is devoid of inclusion bodies, again—and only in the first 10 to 12 days—inclusion bodies will be present in the cytoplasm of the leukocytes.

In keratitis herpetica of the rabbit produced by the herpes virus, inclusion bodies can be found only in the first 24 hours of infection. Other instances could also be enumerated.

The question as to why the inclusion bodies disappear in the later stages of the disease is not yet clear. Perhaps only the stage of acute tissue inflammation gives the elementary bodies the suitable conditions, owing to the iso-electric point of the elementary bodies being on the acid side of the pH, for aggregation into inclusion bodies. In chronic stages, because of a changed pH, these inclusion bodies become scattered and undetectable.

The widespread opinion that there may be a causal relationship between trachoma and a preceding common infection (particularly epidemic conjunctivitis in children)—in the sense that the common infection prepares the ground for the trachoma infection—appears to be a pure misunderstanding. The so-called common conjunctivitis is really just the prefollicular stage of trachoma. This can be easily demonstrated if conjunctival scrapings are taken early enough in the course of the disease and investigated for the presence of inclusion bodies in the epithelial cells.

These findings should make possible a more efficient struggle against trachoma.

2. Morphology of the Agent of Trachoma

According to the first description by Prowazek, the inclusion bodies consist of small particles colored red by the Giemsa method. Prowazek named these particles elementary bodies. Other particles of the inclusion body, which stained blue by Giemsa, are, according to Prowazek, also elementary bodies wrapped by a "coat of plastin," which stains blue like nucleoli.

Plastin, according to Prowazek, appears to be a product of the reaction of the cell cytoplasm with the intruding parasite. It

wraps the elementary bodies like a coat and hence has been named chlamydocyt.

Two years later Lindner attempted to deny the existence of plastin as a blue coat of elementary bodies. According to him, the blue-stained particles are the second form of the bimorphic agent of trachoma. These blue-stained bigger particles received the name "initial bodies." In addition, initial bodies, according to Lindner, very often are found outside of the cell and are then called "free initial bodies." The round, oval, rod-shaped particles, in the form of half-moons, barrels, biscuits, and so forth, are those described as "free initial bodies."

Lindner also describes a particular type of reproduction, tries to show the transformation of initial bodies into elementary bodies, and to state an intricate cycle of division.

This view was soon adopted by all, even by Prowazek, who soon renounced the idea of plastin wrapping the smaller elementary bodies and recognized the dimorphic characteristic of the trachoma virus. In consequence the odd situation arose (just in reference to the elementary bodies of trachoma, for which the term chlamydozoon first was invented) that the existence of the "coat" was denied and thus the first chlamydozoa appeared to have no "chlamys." In recent literature the initial bodies of Prowazek's inclusion bodies, as well as the free initial bodies, are regarded as not less characteristic than the elementary bodies.

However, on reëxamination of all available material of other authors, as well as of a vast amount of my own material, I have come to the opinion that the slight differences in color sometimes encountered in inclusion bodies may result only from the different age of the particles and does not entitle assumption of the existence of two forms of the trachoma virus. In addition, it must be emphasized that both small and larger particles are, for the most part, actually blue-violet. The degree of basophilia of the particles is evidently nothing else than a function of their metabolic activity and consequently also of their division rate, so that bigger particles may appear of a somewhat different tint.

Particularly my attention was drawn to the question of the nature of the "free initial bodies." All photomicrographs and drawings available in the literature were compared with every kind of similar particles to be found in Giemsa-stained scrapings of the conjunctiva both in trachoma and in different nonspecific conjunctivitides.

As a result of this study, I am prepared to state that all forms described as "free initial bodies" may easily be found when profuse decay of lymphocytes—and leukocytes—occurs in the conjunctiva.

Small splinters of the cytoplasm of lymphocytes and especially of decomposed nuclei of polymorphonuclear leukocytes are scattered and frequently phagocytized by Leber's epithelioid cells. The Leber's cells very frequently and readily decay and small nuclear and cytoplasmic splinters of different shapes, especially forms described by authors as free initial bodies, appear outside the cells.

Figures 5 and 10 show on one side an epithelial cell containing elementary bodies, the virus of trachoma, and, in the same visual field near to it, Leber's epithelioid cells of the shape usually described and portrayed as "free initial bodies." (Compare with Axenfeld, Lindner, Loewenstein, Ishihara, and Tshirkowsky.)

In Figure 3, from scrapings of the conjunctiva of a common nontrachomatous conjunctivitis (pneumococci), we see two Leber's cells and around them divers particles described usually as "free initial bodies."

A comprehensive comparative study shows us that "free initial bodies" have nothing in common with the virus of trachoma. The virus of trachoma is thus monomorphic; there exists only one form of the virus, the elementary bodies, with a simple mode of reproduction—division without a complicated cycle.

Furthermore, using a method of impreg-

nation, I found evidence that "initial bodies" were not present in the inclusion bodies of trachoma. In the photomicrographs (figs. 7 and 8) and in Figure 6 we can distinctly see

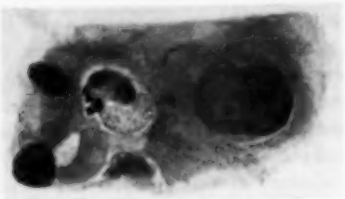

Fig. 6 (Grossfeld). Elementary bodies of an inclusion body impregnated according to Foot.

that the inclusion body consists of particles of quite equal size; that is only of elementary bodies.

3. The nature of the elementary bodies of the trachoma virus

Histochemical investigation must be regarded as a further approach to the question of the nature of the elementary bodies of the virus of trachoma.

Purine compounds contained in any histologic material are promptly decomposed by acid hydrolysis and, thereby, freed groups of aldehydes unite with fuchsin-sulfuric acid, the product of this reaction having a conspicuous red-violet color.

This reaction—the Feulgen reaction—can therefore take place only in tissues containing thymonucleic acid and not in tissues containing only ribonucleic acid. Consequently, the reaction occurs in the nucleus and not in the cytoplasm. Thus the cytoplasmic particles, as for instance the so-called chromidia (polypeptide chains bound up by ribonucleic acid) and also the microscopic mitochondria, never give a positive Feulgen reaction.

If, therefore, we should find a positive Feulgen reaction in the cytoplasm of epithelial cells of a trachomatous conjunctiva, we would have then to assume that the Feulgen-positive particles were necessarily of extracellular origin and that they could originate either from nuclear splinters, occasionally occurring in the cytoplasm, or from the elementary bodies of trachoma virus.

It was necessary to pay attention to the great difficulties connected with an attempt to identify elementary bodies of trachoma virus by the Feulgen nuclear reaction. It is possible to make certain identification of the elementary bodies of the trachoma virus only

Fig. 7

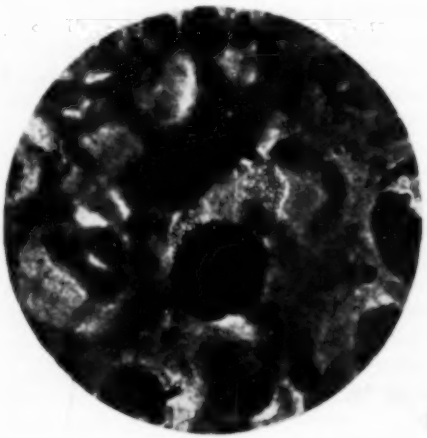

Fig. 8

Figs. 7 and 8 (Grossfeld). Photomicrographs of inclusion bodies impregnated according to Foot.

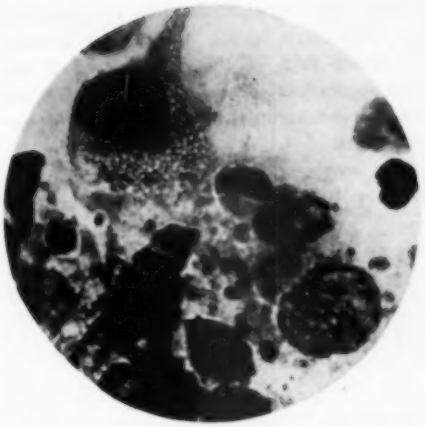

Fig. 9 (Grossfeld). Photomicrograph showing one epithelial cell containing scattered elementary bodies of trachoma. Opposite to it is a Leber's epithelioid cell with divers particles usually described as free initial bodies. From scrapings of a conjunctiva presenting trachoma prefolliculare.

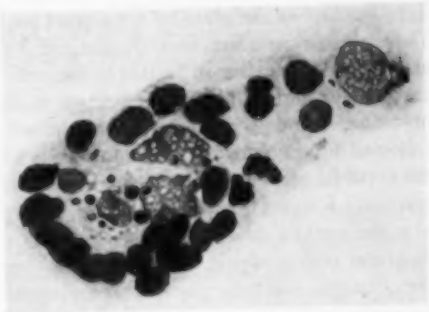

Fig. 10 (Grossfeld). Three Leber's cells (surrounded by small lymphocytes, three leukocytes, and one erythrocyte) containing particles of different size and shape just like those described as free initial bodies. Opposite one epithelial cell with a young inclusion body containing elementary bodies of trachoma. From scrapings of a conjunctiva presenting trachoma prefolliculare.

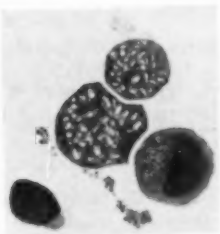

Fig. 11

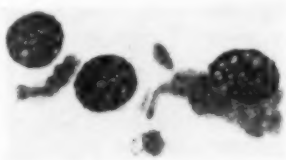

Fig. 12

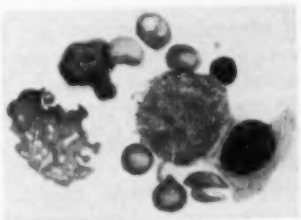

Fig. 13

Fig. 11 (Grossfeld). Elementary bodies of trachoma scattered in the neighborhood of the nucleus of an epithelial cell. Close to it is a big lymphocyte half-filled with phagocytized elementary bodies.

Figs. 12, 13, 14, and 15 (Grossfeld). Elementary bodies of the virus of trachoma, blue-violet when stained by Giemsa.

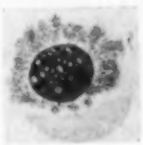

Fig. 14

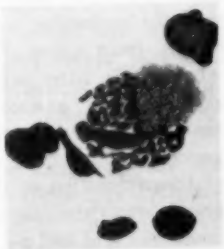

Fig. 15

in those cases in which they are aggregated in the cytoplasm in the form of Prowazek-Halberstaedter inclusion bodies and stained by the Giemsa method.

Since there was no other criterion for identifying the elementary bodies as the virus of trachoma, it was my task to find a method for establishing whether or not cytoplasmic particles eventually found to be Feulgen positive were elementary bodies.

Marking the preparation seemed to me the only practicable way: Scrapings of the conjunctiva from cases of fresh trachoma were stained in the usual way by the Giemsa method. Places where several Prowazek-Halberstaedter inclusion bodies were found

were marked on the glass by a diamond pin. Then the preparation was decolorized by alcohol and thereafter submitted to the ordinary treatment for the Feulgen reaction. A preceding staining by the Giemsa method, followed by decolorization, is no obstacle to the eventual occurrence of a positive Feulgen reaction. I have thus been able to recognize the marked cells containing Prowazek's inclusion bodies which, after treatment for the Feulgen reaction, showed conspicuous red-violet color as a positive Feulgen reaction of the elementary bodies of trachoma (figs. 2 and 4).

By means of histochemical methods, it has been possible to divide the elementary bodies of virus diseases into two big groups. The first group contains chiefly plant viruses. Their elementary bodies consist of molecules of ribonucleoprotein and are Feulgen-negative. The second group contains mainly animal viruses. Their elementary bodies contain desoxy-ribonucleic acid and give a positive Feulgen reaction. Both thymo- and ribonucleic acid, however, have been found in the viruses of influenza. Smallpox virus gives a strong positive Feulgen reaction.

To illustrate the difference between thymo- and ribonucleic acid, it may be recalled that the molecular weight of the former ranges from about 500,000 to 1,000,000; whereas, the latter equals about 5,000. It is also generally assumed that thymonucleic acid constitutes the active substance of the genes, for it has been shown that the ability of transformation of the different types of pneumococci into one another is due to thymonucleic acid and not to the proteinic carrier.

By the method of ionization by X rays of the sensitive places of the elementary bodies it has been shown that, for example, the elementary bodies of vaccinia contain 110 genes each of the diameter of 6 mμ. This shows that these elementary bodies are not simple macromolecules but highly organized units.

My own results show thus that the elementary bodies of the virus of trachoma giving positive Feulgen reaction contain desoxy-ribonucleic acid. This implies that these elementary bodies belong to the class of highly organized viruses which, perhaps, may already be considered as the most primitive cellular units.

My result is also in agreement with the microscopic estimation of the size of the elementary bodies. It is also in accordance with results of my recent investigation in the electron microscope (about 200 mμ) of elementary bodies, in purified material, from scrapings of the conjunctiva of a case of fresh prefollicular trachoma.

Conclusions

1. The prefollicular stage of trachoma —trachoma prefolliculare—is easily diagnosed microscopically. This is of the foremost importance with regard to the early diagnosis, abortive therapy, and epidemiology of trachoma. Its detection marks the right way for the struggle against trachoma.

2. The assumption of the existence of "initial bodies" and of "free initial bodies" of the virus of trachoma can no longer be maintained. Elementary bodies are the only form of the virus of trachoma.

3. The elementary bodies in trachoma contain desoxy-ribonucleic acid and thus constitute highly organized virus particles.

53 East 96th Street.

THE SURGICAL TREATMENT OF EXOTROPIA RESULTING FROM ANTERIOR INTERNUCLEAR OPHTHALMOPLEGIA*

A PRACTICAL EVALUATION OF SOME SURGICAL TECHNIQUES

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The surgical treatment of exotropia is important because of the type of motor defect which presents itself.

Bielschowsky[1,2] stressed the fact that most patients with exotropia have good fusion ability. Their squint is often periodic, and this exotropia can be overcome by a compensating convergence innervation which may be developed by fusion exercises. Yet the exotropia recurs when the patient becomes fatigued. In addition, he said that in divergent squints the possibility of overcorrecting the deviation by surgery is small. Contrariwise, the tendency for a gradual increase of the divergence is the rule, even after surgery.

Refractive errors do not play an important role; whereas, in most cases exotropia is based upon anatomic-mechanical conditions. These conditions may be (1) the diverging axes of the orbits and (2) an aplasia or a congenital defect or an acquired lesion in the medial longitudinal fasciculus.

Spiller[3,4] presented such a case report of a woman, aged 46 years, who died (November 23, 1923) from cardiac decompensation. There were infarcts of the lower lobes of the lungs, associated with vascular lesions in the pontile tegmentum.

He presented microscopic sections of the pontile tegmentum at the level of degeneration, in the medial longitudinal fasciculus. Figure 1-A, B, C, D, E are sections stained with hematoxylin located near the lower limit of the area of degenerated fasciculus.

By examining the section in Figure 1-A, one sees that the area of softening in the tegmentum involved the medial longitudinal fibers on each side of the raphe. Small hemorrhages existed about the blood vessels.

In Figure 1-B the left trochlear nucleus was involved in the degenerative process. Here nerve cells were decreased in number and some showed chromatolysis. In addition, the area of softening destroyed much of the left medial longitudinal fasciliculus and portions of the ventral part of the right medial longitudinal fasciculus.

Figure 1-C, the high-power of Figure 1-A, shows the left side with noted degeneration of the medial longitudinal fasciculus and the left trochlear nucleus.

In Figure 1-D the level of the trochlear nucleus displays degeneration of both medial longitudinal fasciculi.

Figure 1-E, a high power of Figure 1-D, presents the degeneration of each medial longitudinal fasciculus and the left trochlear nucleus.

Holmes[5] said that he had seen isolated paralysis of the internal rectus in lateral movement, though this muscle contracted in convergence—a typical internuclear palsy with exotropia.

Lutz[6] discussed the localization of the pathology and clinical appearance of internuclear palsies.

LeMere[7] reported a case of internuclear paresis resulting from congenital insufficiency of the medial longitudinal fasciculus. Many of the cases herein reported are similar in type to this report of LeMere.

Best[8] discussed the disturbances involved in internuclear defects.

Shimamura[9] injected the right vertebral artery with dye and dissected out the branches. He also injected the basilar arteries. He found that there is a large vessel

* From the Department of Ophthalmology, Children's Memorial Hospital. Presented before the Chicago Ophthalmological Society, December, 1949.

on each side of the raphe in the pons and in the cerebral peduncles. The region of the oculomotor nucleus is supplied by these two systems, the carotids and the vertebral arteries. The blood currents coming from opposite directions meet where the vessels leave the base to penetrate the brain. The vessels entering along the raphe have a vertical course and are end vessels.

Shimamura believed that any fall of blood pressure might produce a lack of blood between the two oculomotor nuclei. Thus, temporary anemia or an anoxemia may result in thrombosis of these end arteries. Softening of the oculomotor areas occurs especially between the internal rectus nuclei. Such lesions are associated with internuclear palsy and exotropia.

Bender and Weinstein[10] produced conjugate deviations by stimulation, and internuclear paresis by destruction of circumscribed areas in the medial longitudinal fasciculus in monkeys.

Berens[11] remarked, in discussing exotropia, that he prefers recession of one or both external rectus muscles unless the deviation is great or the deviating eye is amblyopic. He mentioned the observation that limitation of adduction had resulted in several patients on whom resection of the internal rectus muscles had been done. This occurs in my experience at times. But retroplacement of the external rectus muscles in these cases is not sufficient to produce a satisfactory recovery from the exotropia.

Berens, Losy, and Connolly[12] likewise believed retroplacement of the external rectus muscles advisable in exotropia.

On the other hand, Weekers[13] did not agree with these assertions, but stated that for nonparalytic strabismus (exotropia) bilateral advancement of the internal rectus muscles is advisable, but often is insufficient if the exotropia is of marked degree. Thus, in many cases undercorrection of the exotropia is especially common if amblyopia is

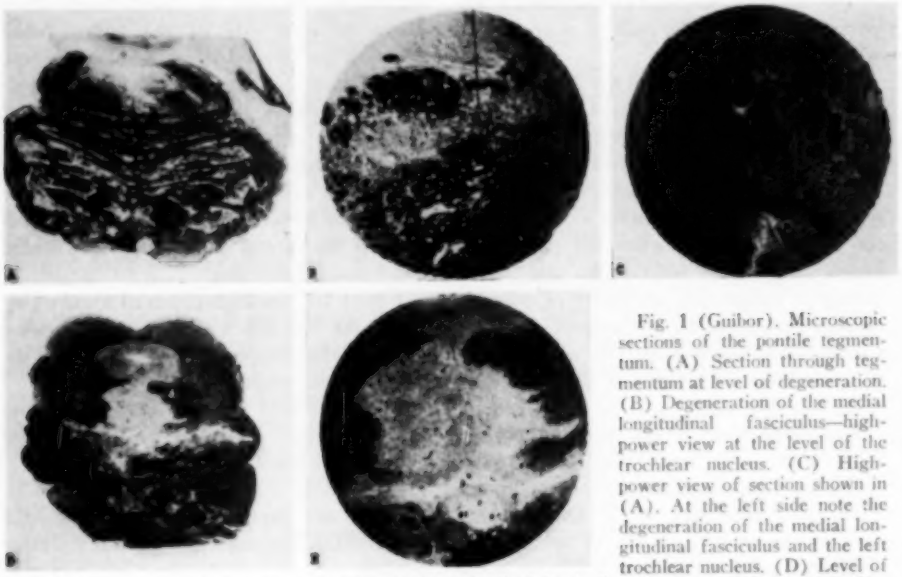

Fig. 1 (Guibor). Microscopic sections of the pontile tegmentum. (A) Section through tegmentum at level of degeneration. (B) Degeneration of the medial longitudinal fasciculus—high-power view at the level of the trochlear nucleus. (C) High-power view of section shown in (A). At the left side note the degeneration of the medial longitudinal fasciculus and the left trochlear nucleus. (D) Level of the trochlear nucleus, degeneration of both medial longitudinal fasciculi. (E) High-power view of (D). Note the degeneration of each medial longitudinal fasciculus and left trochlear nucleus. (From Spiller, W. G.: Brain, **47**:345-357, 1924.)

present or if the patient wishes a monocular operation. In addition, in patients with exotropia resulting from paresis of the internal rectus muscles, any operative procedure is usually successful if the eye is nonparalytic.

Discussion of Material

Previous to this report I have attempted to correct exotropia by: (1) Retroplacement of one or both external rectus muscles, (2) advancement of one internal rectus and recession of both external rectus muscles, and (3) advancement of both internal rectus muscles. In all cases, although the immediate result after surgery appeared to be satisfactory, one year later the exotropia recurred.

Because of these failures in obtaining an adequate and satisfactory elimination of the exotropia, especially by operating only on one eye at a time, it was decided to study and investigate a group of patients who possessed an exotropia associated with the characteristics of internuclear paralysis. The objective findings of such cases are: (1) Exotropia at far and near fixation, (2) insufficiency of one internal rectus or both internal rectus muscles in conjugate lateroversions, and (3) normal convergence.

This paper, therefore, includes a group of 31 patients who possessed the characteristics of an anterior internuclear paresis.

One of these patients, C. C. (table 1), had two operative procedures—an advancement of the left internal rectus (4.0 mm.) and a retroplacement of the left external rectus (4.0 mm.) in 1934. The exotropia was decreased in severity but recurred over a period of several years. The case is therefore recorded as unimproved (table 1).

In 1940, a resection of both internal rectus muscles (10 mm.) and a recession of the right external rectus (4.0 mm.) was done. The exotropia was at first overcorrected and an esotropia of 24Δ to 30Δ was present. Fusion training was done for one year and prisms were worn base-out for three years to correct the esotropia.

TABLE 1

Advancement one internal rectus, retroplacement one external rectus

Patient	Age (years)	Degree of Exotropia	Recovered	Improved	Failure	Operation
M.D.	18	30°			X	Advance. L. int. 4 mm. Retroplace. L. Ext. 3 mm.
M.B.	13	40°		X		Advance. R. Int. 5 mm. Retroplace. R. Ext. 3 mm.
C.C.	19	50°		X		Advance. L. Int. 4 mm. Retroplace. L. Ext. 4 mm.
M.S.	15	50°		X		Advance. R. Int. 4 mm. Retroplace R. Ext. 4 mm.
R.P.K.	30	50°–55°		X		Advance L. Int. 4 mm. Retroplace. L. Ext. 5 mm.
J.D.	35	60°		X		Advance. L. Int. 4 mm. Retroplace. L. Ext. 3 mm.

The patient now has an esophoria of 8Δ at far and an esophoria of 5Δ at near. This patient was, therefore, considered to be recovered cosmetically. There were, therefore, 32 operations on 31 patients.

These patients can be divided into three groups.

Group 1 includes only one patient, I. B., on whom a resection of both internal rectus muscles and a retroplacement of the right external rectus was done—the result was an improvement, but the exotropia of 50 degrees

became an exotropia of 20 degrees and gradually increased in severity. The final result may therefore be considered a failure even though the exotropia was recorded as improved. (This case is not included in either table.)

Group 2 includes six patients upon whom an advancement of one internal rectus and a retroplacement of one external rectus muscle was done. Of these six, five were improved, one was unimproved and, none was relieved of the exotropia (table 1).

TABLE 2

BILATERAL RESECTION AND RETROPLACEMENT

Patient	Age (years)	Degree of Exotropia	Recovered	Improved	Failure
J.W.	33	20°	X		
H.H.	25	30°	X		
D.B.	6	35°–55°	X		
M.D.	5	35°–60°	X		
H.B.	5	40°		X	
R.D.	19	40°–60°	X		
K.E.	19	45°–60°		X	
F.H.	30	50°	X		
C.C.	19	50°	X		
H.M.	7	50°	X		
S.P.	26	50°	X		
M.V.	12	50°	X		
L.S.	9	55°	X		
M.B.	6	60°			X
B.J.	6½	60°	X		
J.F.	14	60°	X		
B.G.	24	60°	X		
A.K.	17	60°			X
A.K.	17	60°	X		
R.R.	11	60°	X		
M.R.	9	60°	X		
W.S.	10	60°	X		
D.W.	12	60°	X		
C.G.	23	65°	X		
L.D.	31	80°	X		

Group 3 includes 25 patients upon whom there was done a (10 mm.) resection of each internal rectus and a (3.0 to 4.0 mm.) retroplacement of each external rectus muscle at one operative procedure. Of these 25, 21 had no exotropia by cover test, two were improved, and two were unimproved after surgery. These patients were observed from one to four years (table 2).

In examining Table 2, one notices that, with one exception, the exotropia was 30 to 80 degrees. The greatest number of patients had an exotropia of 60 degrees, five patients had an exotropia of 50 degrees, one of 80 degrees, and one of 20 degrees.

From this study one cannot conclude, therefore, that a special operative procedure such as resecting an internal rectus will result in a certain number of millimeters in improvement.

One must conclude, however, that overcorrecting of an exotropia resulting from an internuclear palsy by resection of both internal rectus muscles and retroplacement of both external rectus muscles is difficult to produce. For example, J. W., with an exotropia of only 20 degrees, was subjected to a resection of both internal rectus muscles (10 mm.) and a retroplacement of both external rectus muscles (3.0 mm.). The immediate result obtained was an esotropia of 10 degrees, which gradually decreased until there existed an exophoria of six prism diopters.

Let us note in addition the case of L. D., with an exotropia of 80 degrees. On this patient there was done a resection of both internal rectus muscles (10 mm.) and a retroplacement of both external rectus muscles (3.0 mm.). The patient has no exotropia two years after operation.

In order to demonstrate the efficiency of the surgical correction herein presented, I wish to present a case report.

CASE REPORT

R. D., a young man, aged 19 years, a college student, possessed an alternating exotropia, which had been noticed at birth. He complained of diplopia and fatigue when using his eyes. At times he had attacks of minor and major convulsions.

Ophthalmic examination. There was present an alternating exotropia of 20 to 60 degrees (fig. 2-A and B) at far and at near fixation, by the Hirschberg test; 60 degrees by the perimeter corneal reflection test. The exotropia was of such a severe amount that it could not be measured in prism diopters by means of the cover test (fig. 2-A and B).

A weakness of the left internal rectus in dextroversion (fig. 2-C) and of the right in-

ternal rectus in levoversion (fig. 2-D) made visible 4.0 mm. of sclera; looking to the left, 4.0 mm. of sclera were visible. The near point of convergence could not be obtained at this time (August 26, 1944).

Unaided visual acuity was: R.E., 20/50, 14/14; L.E., 20/200, 14/14. Manifest refraction yielded corrective lenses of R.E., −1.0D., L.E., −1.0D. Corrected visual acuity was: R.E., 0.8+2, 14/14; L.E., 0.6+2, 14/14. The correcting lenses did not change the deviation of the eyes. Homatropine retinoscopy revealed: R.E., +0.25; L.E., +0.25.

The diagnosis was internuclear paralysis with exotropia.

Operation. On August 28, 1944, the following surgery was done under local anesthesia: a 10-mm. resection of each medial rectus, a 6.0-mm. retroplacement of the left lateral rectus, and an 8.0-mm. retroplacement of the right lateral rectus.

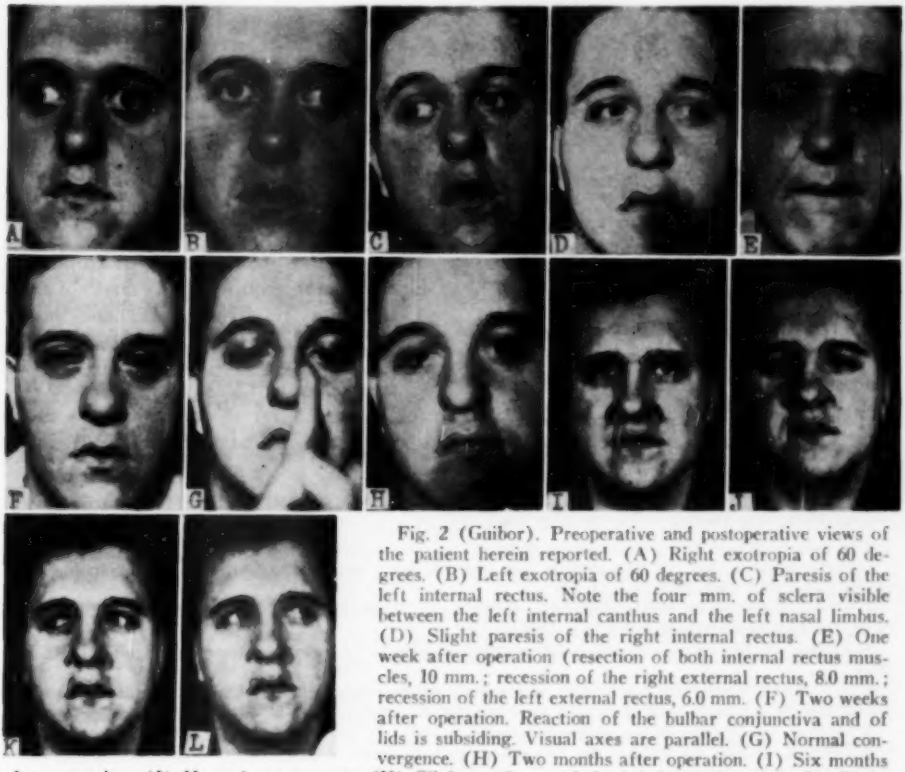

Fig. 2 (Guibor). Preoperative and postoperative views of the patient herein reported. (A) Right exotropia of 60 degrees. (B) Left exotropia of 60 degrees. (C) Paresis of the left internal rectus. Note the four mm. of sclera visible between the left internal canthus and the left nasal limbus. (D) Slight paresis of the right internal rectus. (E) One week after operation (resection of both internal rectus muscles, 10 mm.; recession of the right external rectus, 8.0 mm.; recession of the left external rectus, 6.0 mm. (F) Two weeks after operation. Reaction of the bulbar conjunctiva and of lids is subsiding. Visual axes are parallel. (G) Normal convergence. (H) Two months after operation. (I) Six months after operation. (J) Normal convergence. (K) Slight weakness of the left internal rectus. (L) Slight weakness of the right internal rectus.

Ten days after the operation the patient was photographed (fig. 2-E). Considerable reaction was present which subsided rapidly during the first postoperative month (fig. 2-F). Three months later (fig. 2-G, H, I, J, K, L) examination revealed the near point of convergence to be three centimeters (fig. 2-G and J). There existed an exophoria of 1Δ at far fixation, exophoria 3Δ to esophoria 4Δ at near vision. A slight weakness of each

internal rectus persisted (fig. 2-K and L). Two mm. of sclera were visible in the right eye during levoversion; five mm. in the left eye during dextroversion.

Six months after the operation there was an exophoria of 3Δ at far and 5Δ at near fixation. Visual acuity without glasses was: R.E., 20/40; L.E., 20/40. With correcting lenses it was R.E., 20/13; L.E., 20/13. The near point of convergence was two cm. The adduction weakness in each eye was three mm., the abduction weakness of each eye four mm.

The vergences (prism ductions) after six months were:

	Fixing at 20 feet	Fixing at 13 inches
Divergence	6Δ	40Δ
Convergence	65Δ	15Δ
Supravergence	6Δ	6Δ
Infravergence	8Δ	7Δ

Summary

This is a study of 31 patients with exotropia associated with internuclear palsy who received surgical treatment. Advancement of the internal rectus muscles without resection and without retroplacement of the external rectus muscles was unsuccessful. Advancement of one internal rectus with retroplacement of the external rectus was unsuccessful in eliminating the exotropia in six patients.

In the exotropia existing in 25 patients, the average deviation was 60 degrees. The divergent squint was corrected by bilateral resection of the internal rectus muscles of 10 mm. with bilateral retroplacement of the external rectus muscles. In this series these surgical procedures on the four horizontal rectus muscles were more successful when done in one operative procedure than any other operations attempted.

Conservative treatment of exotropia resulting from internuclear palsy does not yield as satisfactory results as simultaneous resection of the internal rectus muscles and retroplacement of the external rectus muscles.

30 North Michigan Avenue (2).

I wish to thank Dr. Richard C. Gamble for his help and consideration in the preparation of this paper.

References

1. Bielschowsky, A.: Die Innervation der Musculi recti interni als Seitlenwaender. Setzungsb. d. ophth. Gesellsch., 1902-1903, pp. 164-171.

2. ———: Lectures on Motor Anomalies of the Eye: VI. Principles of Surgical Treatment. Hanover, N.H., Dartmouth College Publications, 1940, p. 51.

3. Spiller, W. G.: Ophthalmoplegia internuclearis anterior: A case with necropsy. Brain, **47**:345-357, 1924.

4. ———: Unilateral (unassociated) innervation of the ocular muscles. Arch. Neurol. & Psychiat., **18**:691-708 (Nov.) 1927, Arch. Neurol. & Psychiat., **28**:251, 1932.

5. Holmes, G.: Palsies of the conjugate ocular muscles. Brit. J. Ophth., **5**:241, 1921.

6. Lutz, A.: Ueber die Bahnen der Blickwendung und deren Dissuziierung. (Nebst Mitterlung eines Falles von Ophthalmoplegia internuclearis anterior in Verbindung mit Dissoziierung der Bogengange). Klin. Monatsbl. f. Augenh., **70**:213-235, 1923.

7. LeMere, F.: Ophthalmoplegia iternuclearis (due to congenital weakness of medial longitudinal fasciculus). Arch. Neurol. & Psychiat., **50**:585-586 (Nov.) 1943.

8. Best, F.: Localization of cerebral lesions producing disturbances of homolateral eye movements. Arch. f. Ophth., **144**:25-40, 1941.

9. Shimamura, S.: Uber die Blutversorgung der Pons und Hinschenkel gegend, insbesondere des oculomotorius Kerns. Neurolog. Centrabl., **13**:769-780, 1894.

10. Bender, M. B., and Weinstein, E. A.: Effects of stimulation and lesion of medial longitudinal fasciculus in monkeys. Arch. Neurol. & Psychiat., **52**:106-113 (Aug.) 1944.

11. Berens, C.: Resection operation for strabismus. Arch. Ophth., **8**:8 (Sept.) 1932.

12. Berens, C., Losey, R. R., and Connolly: Retroplacement for strabismus. Am. J. Ophth., **12**:722 (Sept.) 1929.

13. Weekers, L.: Two operative procedures of strabismus: Muscle advancement and shortening. Bull. Soc. belge d'Opht., **78**:43-60 (Aug.) 1939.

SIMULTANEOUS BILATERAL PRIMARY OCULAR MALIGNANT MELANOMA*

Report of a case

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The occurrence of proved simultaneous bilateral ocular malignant melanomas is of sufficient rarity to warrant the reporting of such a case which was also associated with a benign melanoma of the eyelid.

As pointed out by Duke-Elder[1] bilateral malignant melanomas of the uveal tract are very exceptional. Fuchs[2] in his basic and oft-quoted treatise on the subject of malignant melanomas, published in 1882, reported five bilateral cases from the literature. He stated that the diagnosis had not been confirmed in all of them.

Wintersteiner[3] in 1902 reported five cases which were the same as those reported by Fuchs. In 1930 Shine,[4] in presenting a similar case, reported finding seven cases in the literature. An analysis of his case, however, discloses that those reported by Meigs and de Schweinitz[5] in 1894 and the one reported by Meyer Weiner[6] in 1903 were ocular metastases from nonmelanotic sarcomas.

A search of the literature has failed to reveal any other cases reported since 1930. From the above it is apparent that only six cases warrant consideration here.

The first case to be reported as a bilateral primary melanosarcoma was that presented in 1865 by Schiess-Gemuseus.[7] His patient, a 59-year-old woman, developed an ocular inflammation that had the clinical appearance of a severe plastic iridocyclitis. Both eyes were involved almost simultaneously, although the left eye progressed more rapidly, and in nine months had become somewhat atrophic and painful so that it was enucleated. A year later the woman died and the right eye, which had become somewhat smaller, was removed.

In it there was a diffuse thickening of the choroid, comprised in part of small round cells and in part of fibrous tissue. There was a small amount of pigment present. The left eye was almost completely filled by a white mass composed of small round cells. There was no pigment present.

Fuchs[2] felt that this was not a case of sarcomatosis but a marked bilateral inflammatory reaction. Wintersteiner[3] stated that in his opinion the condition was probably a tuberculosis of the choroid. From the above it is apparent that this case cannot be considered as a proved case of malignant melanoma.

The second case to be reported was that of Landesberg.[8] His patient was a 61-year-old man, whose right eye had had a detachment of the retina for five years. He requested treatment because of severe pain in the eye and at the time of enucleation presented a picture of absolute glaucoma. On sectioning the eye, a pea-sized unpigmented mass was found in the choroid in the posterior pole. This was composed of spindle cells.

Simultaneously the left eye became involved. Examination revealed a circumscribed detachment of the retina at the posterior pole with a corresponding scotoma. The retina was elevated and covered with small white spots. The condition progressed very slowly and for a period of three years appeared to remain stationary.

Later Landesberg heard that the left eye had become painful and glaucomatous and that the patient had developed signs of increased intracranial pressure. He assumed that the second eye also contained a malig-

* From the Division of Ophthalmology, University of California Medical School. Presented at the 85th annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1949.

nant sarcoma but the diagnosis was never confirmed.

Carter[9] reported the third case in 1874. His patient was a boy, aged 15 years, who three months prior to the first examination had noticed a dark speck in the left iris. It had steadily increased in size and began to interfere with his vision. Three weeks prior to entry he had noticed a similar speck in the right eye. Examination showed a pea-sized nodule in the lower nasal quadrant of the left iris, and 2 pinhead sized flecks in the outer half of the right iris. The nodule on the left was removed by iridectomy. Recovery was slow and accompanied by a persistent iritis. Nine months later the patient was seen again. There was little visible increase in the size of the growths, "but vision, even of the right eye, is limited to the perception of large objects, and there are distended vessels emerging from the interior of both." The microscopic examination of the excised nodule was reported as a round-cell sarcoma but without detailed description. Fuchs[2] remarked that with the multiplicity of tumors in each eye it is conceivable that this case might be one of tuberculosis of the irides. Wintersteiner[3] also concluded that it was probably tuberculosis. In any event, here again the diagnosis of the condition in the second eye was not confirmed microscopically.

The fourth case was reported by Dixon[10] in 1878. His patient, a 50-year-old man, developed neuralgic pains in the left eye accompanied by ciliary injection. Later the vitreous became cloudy and the patient developed a complete detachment of the retina; iridectomy failed to relieve the glaucoma that developed and the eye was enucleated because of pain. Microscopic examination revealed a pigmented round-cell sarcoma of the ciliary body. Six months later the patient developed a similar condition in the right eye but refused to "take care of himself." He died five months later. "Excessive pain wore out his life." Not being notified of the patient's death until after his burial, Dixon did not have the opportunity of obtaining the second eye. He concludes that inasmuch as the second eye resembled so closely the left, it was quite likely the condition was identical.

The fifth case is the one reported by Hirschberg[11] in 1880. The patient, a 56-year-old woman, was seen with a totally blind right eye in which a tumor had perforated the globe "upward and inward." The eye was enucleated and microscopic examination revealed a melanotic sarcoma. One year later the patient developed visual disturbances in the remaining eye. Examination revealed a large yellow tumor with injected blood vessels extending into the vitreous on the nasal side of the ciliary body. A month later the eye was totally blind.

The eye was not obtained for examination but Hirschberg felt that this eye contained a tumor similar to the one in the right eye. He concluded that the second tumor was primary as he "did not like to consider this second eye as metastatically affected, since there is a general law that those organs in which sarcomas appear primarily are seldom affected by metastasis from other localities."

The only other case that we have been able to find in the literature is that presented by Shine[4] in 1930. His patient, a 35-year-old man, suddenly developed severe pain in the right eye. Examination showed a "small brownish-black deeply pigmented mass protruding into the anterior chamber through the outer lower quadrant of the iris." The eye was enucleated and a diagnosis of malignant melanoma of the iris was confirmed microscopically.

Three years later the patient was seen with a large detachment of the retina in the left eye and a diagnosis was made of sarcoma of the choroid. Physical examination was negative except for an X-ray report of possible metastatic tumors of the left lung. Three years later the eye was blind and painful and was enucleated. Pathologic examination reported a spindle-cell malignant melanoma. The patient died a year later of "melanotic sarcoma of the abdomen."

Case report

History. Mrs. E. C., aged 49 years, was admitted to the San Francisco Hospital on September 13, 1948, with a diagnosis of myocardial infarction. The history disclosed that she had been losing vision in her left eye for the past four years. Because of this, ophthalmologic consultation was requested.

A review of the records revealed that the patient was first seen in the University of California Eye Clinic in January, 1939, for routine refraction. The vision at this time was 20/20 in each eye. She returned on March 13, 1944, complaining of dimness of vision of the left eye of four months' duration. Vision of the left eye could not be improved beyond 20/100. Perimetric studies showed a defect in the nasal field, but no lesion could be made out in the fundus. A melanoma of the right lower lid was noted at this time.

The patient failed to return for further observation until April 10, 1945, when she reported because of a recent blow to the left eye. Vision of the left eye was 20/100, unimproved by refraction. Examination of the right eye revealed an iris freckle at the 8-o'clock position and on fundus examination the left eye's macular area was noted to be darker than that of the right eye. She was advised to return for central and peripheral field studies and further observation but failed to do so.

Fig. 1 (Cordes and Cook). Right eye, showing benign melanoma of lower lid.

Fig. 2 (Cordes and Cook). Right eye, showing malignant melanoma of the iris, together with iris freckles.

In the San Francisco Hospital, upon further questioning, the patient stated that the loss of vision had been gradual and that she had not consulted anyone regarding her eyes as she felt the further visual loss was the result of the blow to the eye.

Examination. Vision was: R.E., 20/20; L.E., no central vision.

Right eye. There was a flat pigmented lesion of the lower lid involving the medial third of the lid margin, including the punctum (fig. 1).

The iris showed a nodular, pigmented, elevated mass at the 8-o'clock position, sparing the sphincter and apparently the iris root. A small freckle was noted at the 2-o'clock position and a smaller one at the 3-o'clock position (fig. 2). The fundus was essentially negative.

Left eye. External examination negative. Fundus examination revealed a detachment of the retina extending from the posterior pole temporally. The lesion was elevated, solid appearing, and obviously pigmented. The retina was also detached peripherally and below (fig. 3).

Fig. 3 (Cordes and Cook). Left eye, showing malignant melanoma of the choroid.

Perimetric field studies showed a large field defect corresponding to the retinal lesion in the left eye.

Intraocular pressure: 18 mm. Hg (Schiøtz) both eyes.

With the gonioscope it appeared that the angle was free peripheral to the lesion in the right iris.

Medical consultation failed to reveal any evidence of metastases or a primary growth elsewhere. Urine studies showed no melanin, and the liver function was normal.

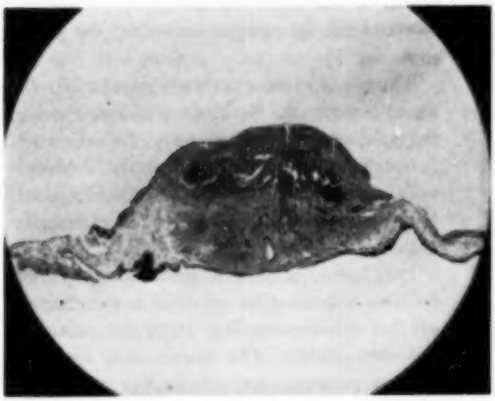

Fig. 4 (Cordes and Cook). Section through malignant melanoma of the right iris.

Diagnosis. Benign melanoma of the right lower lid; malignant melanoma of the right iris; pigment freckles right iris; malignant melanoma of choroid, left eye.

On October 13, 1948, a wide basal iridectomy of the right iris was performed, including the tumor and sparing the sphincter. A few days later the left eye was enucleated. Convalescence was uneventful.

The patient is still under observation and to date shows no signs of local recurrence or generalized metastases.

Pathology report

The following is the résumé of the pathology reports submitted by Dr. Michael J. Hogan:

Tumor of the iris

Clinical diagnosis: Malignant melanoma of the iris.

Gross examination. The specimen consists of a portion of iris tissue containing a pigmented tumor in its center. The tumor is elevated above the anterior iris surface and measures approximately three mm. in diameter. There are several large vessels extending from the root of the iris toward the growth. The specimen was oriented so that the pupillary and ciliary portions could be identified and sectioned serially from one margin to the other margin of the growth.

Microscopic examination. Serial sections show that the growth has been completely excised. A tumor arises from the stroma of the iris near the center and extends from the anterior layer almost to the pigment epithelium (fig. 4). The growth is rather circumscribed. On the surface of the iris there is a slight extension toward the root but for only a very short distance. The surface of the tumor is elevated and slightly irregular.

The tumor contains a moderate amount of pigment. It is composed mainly of fairly large spindle-shaped

cells with oval or rounded nuclei. The chromatin of the nuclei is rather heavy and diffusely distributed. Although most of the cells do not contain nucleoli, a fair number contain them in small areas. Pigment is noted within these cells and in chromatophores throughout the growth. Occasional mitotic figures are seen. Reticulum stains show a light fiber content (fig. 5).

Diagnoses: Malignant melanoma, iris; completely excised; spindle cell A and B.

ENUCLEATED LEFT EYE

Clinical diagnosis: Malignant melanoma, choroid.

Gross examination. The specimen is a left eye measuring 22 by 23 by 23 mm. A corneal transplant button has been removed from the central cornea. Horizontal calottes were made. There is a malignant melanoma arising from the choroid on the temporal side and extending from near the disc to the equator. It is only lightly pigmented. The tumor measures 10 mm. meridionally and is elevated four mm. There is a retinal separation surrounding it.

Microscopic examination was essentially negative except for the posterior segment.

Choroid. A rather circumscribed malignant melanoma arises in the choroid on the temporal side of the globe about three disc diameters from the disc and extending out to the equator. The tumor has not penetrated Bruch's membrane. On the external side it has not invaded the sclera but the emissarium of the long posterior ciliary artery is invaded by tumor cells. The growth is moderately pigmented and is composed almost entirely of spindle-shaped cells, arranged in fascicular fashion. The cells contain rounded or oval nuclei and one or more nucleoli (fig. 6). Silver stains show a light content of coarse and fine reticulum fibers (fig. 7).

Retina. The retina is partially separated over the tumor by a serous exudate. There is also some edema and degeneration of the stroma of the retina with destruction of the rod and cone fibers and areas of adherence

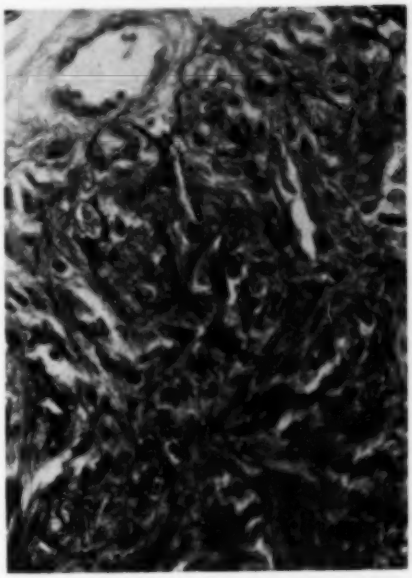

Fig. 5 (Cordes and Cook). Reticulum stain of right iris tumor, showing moderate fiber content.

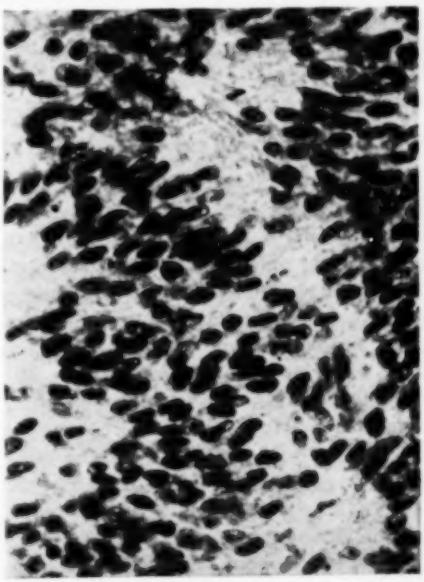

Fig. 6 (Cordes and Cook). Left eye. Choroidal tumor, showing character of cells. (High power.)

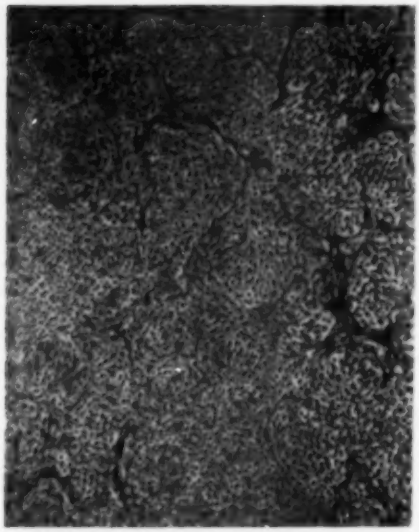

Fig. 7 (Cordes and Cook). Reticulum stain, choroidal tumor, showing moderate fiber content.

of retina to Bruch's membrane. The pigment epithelium is also degenerated in this area.

Diagnoses: (1) Malignant melanoma of the choroid, Stage I, pigmentation 1+, fascicular type; (2) separation retina, due to tumor.

Excision of nevus of the right lower lid

Gross examination. A pigmented piece of tissue containing hairs from the lid margin and measuring 4 by 3 by 3 mm. Sections were made at right angles to the lid margin.

Microscopic examination. The epidermis shows moderate keratinization of the surface layers and has a normal breadth. The basal layers show considerable pigmentation. Beneath the epithelium is a very moderately pigmented growth which is not circumscribed (fig. 8). It extends from a short distance below the epithelium a fair distance into the derma. Toward the margin the cells of the growth are grouped in clusters and contain more pigment. Centrally the cells are more diffusely arranged except that near the epithelium they tend to form clusters and short columns. The cells which lie in circumscribed groups are small and deep, staining with a scanty cytoplasm and angular nuclei. The remaining cells which are more diffusely scattered are slightly larger with a more abundant cytoplasm and rounded nuclei. There is no evidence of developing malignancy in this growth.

Diagnoses: Nevus, eyelid, growing.

Sections were sent to Mrs. Helenor C. Wilder at the Army Institute of Pathology, and the following comment made: "The left eye shows a malignant melanoma of the choroid, fascicular type. The fiber content is somewhat less than 50 percent. The tumor

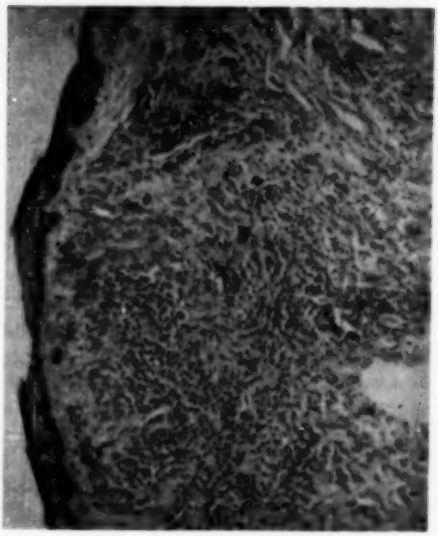

Fig. 8 (Cordes and Cook). Section through biopsy of nevus, right lower lid.

from the iris of the right eye is an early malignant melanoma, predominantly spindle A but with some anaplasia at the center. Here, again, the fiber content appears surprisingly low. The tumor does, however, appear to have been completely excised."

Comments

Of the six cases considered above, two are probably not malignant melanomas, but

are cases of ocular tuberculosis (Schiess-Gemuseus and Carter). This leaves only four cases that can be considered as being malignant melanomas. Of this group of four, only in Shine's case was the diagnosis of the other eye confirmed. Only in Landesberg's patient was the second eye involved simultaneously; in Dixon's case the time interval was six months, in Hirschberg's one year, and in Shine's patient the second eye was not involved until three years later. In Landesberg's patient both choroids were involved, while in Dixon's it was the ciliary body of both eyes. Hirschberg's is not confirmed but apparently the choroid was involved in the first eye and the ciliary body in the second eye. Only in Shine's patient was the distribution similar to our case in that the iris of one eye and the choroid of the other eye were involved.

Bilateral malignant melanomas may be either metastatic or coincident primary tumors. Fuchs[12] in his analysis of the literature stated that metastatic choroidal sarcoma is unknown and quoted Virchow, who said, "Those organs which exhibit a great tendency to protopathic tumor formation present a very slight inclination to metastatic deposits." Since this was written, Cordes and Horner,[13] Meyer Weiner,[6] and others have reported instances of bilateral intraocular metastases of malignant melanoma from a primary site elsewhere in the body. However, careful search failed to reveal evidence of a primary tumor elsewhere in the body of our patient.

If the multiple primary tumors coexist, it should be of interest to compare histologic cell types and structure to determine if they differ markedly. In attempting to do this, certain difficulties arise. As Parsons[14] has pointed out, extraocular extensions often show differences of structure from the intraocular growths and the extraocular growth is often nonpigmented though the primary tumor is melanotic. He also brought out the fact that sarcomas of the choroid are not infrequent in which different portions show a very different histologic pattern.

In the pathology report and in an attempt to compare histologic cell types and structure of the two tumors the classification of Callender, Wilder, and Ash[15] has been employed.

In the iris tumor of our case, Dr. Hogan felt that the cells were the spindle A and B variety, while Wilder classified it as spindle A. In the malignant melanoma of the choroid it was spindle B and fascicular, which would be classified as fascicular. Thus the two simultaneous binocular tumors do not fall into the same classification, which would tend to substantiate the contention that they were both primary.

Of further interest in this case is the presence of a large coexisting nevus of the right lower lid together with iris freckles in the right iris. Reese[16] in a paper on iris freckles states that although benign melanomas of the iris were noted in about 40 percent of normal adult eyes, he has personally been impressed with the more frequent occurrence of the benign lesions in the microscopic sections of eyes harboring malignant melanomas of the uveal tract. It is noteworthy in the case reported here that three and one-half years previously an iris freckle had been observed at the site of the malignant melanoma of the iris.

The difference, histologically, between the normal and those occurring with malignancy seems to be one of degree. The former tend to be merely a localized accumulation of densely pigmented melanoblasts only a few cells thick along the anterior surface of the iris, while the latter tend to be slightly more elevated anteriorly and extend deeper into the stroma.

Reese[17] also brings out that sometimes a malignant melanoma is associated with generalized melanosis in which pigment is seen in the connective tissue and reticulo-endothelial cells. It is questionable whether this is a result of phagocytosis of pigment dis-

persed from the primary site of the tumor, or whether these scattered cells have metamorphosed into true melanoblasts.

In discussion of the pathogenesis of uveal melanomas, Reese divides them into two groups, on the basis of their anlage; that is, neurogenic melanomas and chromatogenic melanomas. Their relative occurrence, as he was able to classify them, was about twice as many neurogenic as chromatogenic types. He further correlates them with the prognostic values of Callender, Wilder, and Ash's classification by assuming that spindle A and B and fascicular represent mostly neurogenic melanomas which have a mortality of about 20 percent, and the necrotic, mixed and epithelioid were mostly chromatogenic melanomas with a mortality of about 60 percent.

The case presented appears to be the fifth authentic case of a bilateral primary malignant melanoma of the eye and the second one in which the diagnosis was confirmed microscopically in the second eye. It is also the second instance where both eyes were involved simultaneously. The two tumors differed a sufficient amount morphologically to bear out the contention that both are primary. Of further interest was the coexistence of a benign nevus of the lower lid and two iris freckles.

Summary

A case is reported of a 49-year-old woman with simultaneous bilateral ocular malignant melanomas, one of the iris of the right eye, the other of the choroid of the left.

The left eye was enucleated and an iridectomy for the tumor of the right iris was performed. Microscopic examination confirmed the diagnosis; the tumors differed sufficiently to warrant the assumption that they were both primary.

There was no evidence of a primary tumor elsewhere in the body and no evidence of metastasis.

A concurrent benign nevus of the right lower lid was also present.

A search of the literature revealed only six similar cases. Of these, the consensus is that two were tubercular in origin.

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References

1. Duke-Elder, W. S.: Textbook of Ophthalmology. St. Louis, Mosby Co., 1941, v. 3, p. 2479.
2. Fuchs, E.: Das Sarcom des Uvealtraktus. Wien, W. Braumuller, 1882, p. 232.
3. Wintersteiner: Enzyklopadie d. Augenheilkunde. Leipzig, 1902, p. 19. (Data obtained from photostated copy from Army Medical Museum.)
4. Shine, F. W.: New York Eye & Ear Clinical Report, **1**:31, (Mar.) 1930.
5. Meigs, A. V., and de Schweinitz, G.: Am. J. M. Sc., **108**:193, 1894.
6. Weiner, M.: Am. J. Ophth., **19**:345, 1902.
7. Schiess-Gemuseus: Virchows Arch. f. Path. Anat., **33(B)**:495, 1865.
8. Landesberg: Arch. Ophth., **15**:210-214, 1869.
9. Carter, R. B.: Tr. Clin. Soc. London, **7**:60, 1874.
10. Dixon, L.: Tr. Am. Ophth. Soc., **2**:432, 1878.
11. Hirschberg, J.: Arch. Ophth., **10**:71, 1881.
12. Fuchs, E.: Das Sarcom des Uvealtraktus. Wien, W. Braumuller, 1882, p. 238.
13. Cordes, F. C., and Horner, W. D.: J.A.M.A., **95**:655, August 30, 1930.
14. Parsons, J. H.: The Pathology of the Eye. New York, Putnam, v. 2, p. 493.
15. Callender, G. R., Wilder, H. C., and Ash, J. E.: Am. J. Ophth., **25**:962 (Aug.) 1942.
16. Reese, A. B.: Am. J. Ophth., **27**:217 (Mar.) 1944.
17. ———: Am. J. Ophth., **30**:537 (May) 1947.

LAMELLAR KERATOPLASTY*

Technique and Results: Comparative study with penetrating keratoplasties and keratectomies

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In 1930 I carried out some experiments on animals' eyes to determine which type of keratoplasty gave the best results.[1,2] Comparison of the crystal-like appearance of partial penetrating grafts with lamellar grafts where a more or less pronounced cloudiness was always detected at the base of the cicatrization led me to the conclusion that the lamellar type of keratoplasty did not give suitable visual improvement. From that time, therefore, I limited my experimental work on animals' eyes and later my clinical work on human eyes to the exclusive use of the penetrating type of keratoplasty.[3-6]

In 1938, however, I attempted a total lamellar keratoplasty in an extremely unfavorable case of a patient affected with a densely vascularized leukoma caused by a sulfur-dioxide burn. The operation was carried out by excising from the entire area of the cornea about three fourths of the outer layers containing the vascularized scar, replacing this tissue with a whole thickness of cornea minus the endothelium which had been scraped with a curette. Healing took place uneventfully during the first two weeks, with the transplant remaining clear. Then interstitial vascularization occurred at the base of cicatrization which, after running a course of about three weeks, receded completely but left the graft cloudy. The eye had no better vision than before the operation.

In spite of failing to obtain visual improvement, I was interested in finding out whether the transplanted cornea would offer a better bed for a partial penetrating graft than the original vascularized leukoma. Six months after the lamellar keratoplasty, a partial penetrating graft was placed in the center of the cornea. The transplant remained clear for three weeks, but afterward gradually became opaque. This clinical experiment convinced me at that time that this particular type of lamellar keratoplasty was not beneficial either as an operation to improve vision or as a preliminary surgical treatment to prepare the eye for a final partial penetrating keratoplasty.

In 1947, at the meeting of the French Ophthalmological Society, I was greatly impressed with the unquestionably excellent results reported by Paufique, Sourdille, and Offret[7] with the partial and total lamellar types of keratoplasty. In a personal communication which I received from Paufique,[8] he gives the indications for lamellar keratoplasty as follows:

"*1. Indications for optical keratoplasty.* The operation is indicated whenever the cornea presents only superficial lesions where it is possible to obtain good improvement in vision without any risk to the patient. The same improvement may also be obtained with a penetrating keratoplasty but it is certain that the risk is greater and one must carefully select the surgical procedure to be used in patients who are not completely blind but who still have visual acuity of 1/20 or 1/10.

"Lamellar keratoplasty should be carried out in nervous patients or in patients affected with nystagmus, particularly in patients with only one eye or when the eye is aphakic and has vitreous fluid in the anterior chamber.

"The best results are obtained in corneal dystrophies, especially nodular dystrophies, Groenow's and Haab-Dimmer types, where 90 percent very good results may be obtained.

"Among other forms of corneal degenera-

* From the Institute of Ophthalmology, Columbia-Presbyterian Medical Center. Presented at the 85th annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1949.

tion where lamellar keratoplasty gives good results are fatty corneal dystrophy and primary chronic corneal edema (Fuchs's dystrophy).

"Results are also good in sequelae of infectious keratitis: Hutchinson's, tubercular, rosacea, eczematous keratitis, and that caused by neurotropic viruses. Superficial opacities remaining after ulcers are also a good indication. In trachomatous scarring, after eliminating associated infections, lamellar keratoplasty may be put to good use. In traumatic keratitis caused by foreign bodies, mine explosions, and different chemical burns, the results are often not so good but, if lamellar keratoplasty is not sufficient to improve vision, the performance of a penetrating keratoplasty can be carried out afterward under better conditions. Keratitis caused by mustard gas, however, is an excellent indication for lamellar keratoplasty.

"My statistics [Paufique] of 270 lamellar transplants including all cases, good and bad, show that 75 percent of the transplants remained transparent with favorable functional results.

"In cases in which improvement has not been obtained, a certain opacity of the lamella in the cornea of the host remains under the graft. During the months following the operation, there is sometimes an improvement in the opacity in the host's cornea by trophic action of the transplant with subsequent progressive functional improvement. If vision obtained after a lamellar keratoplasty is not sufficient, it is possible to carry out a penetrating keratoplasty under better conditions in a cornea which has been greatly improved from the anatomic point of view.

"*2. Indications as a preliminary operation to penetrating keratoplasty.* In very dense leukomas, particularly in those greatly vascularized, penetrating keratoplasty often results in opacification of the graft. In these cases, it is always preferable, in the first stage, to make the lamellar keratoplasty as deep as possible, varying the size with the extent of the leukoma. Three months later, if the preliminary transplant has remained clear without vascularization, it will be possible to perform a penetrating keratoplasty with great probability of success. In such cases, the usefulness of keratectomy could be pointed out but the advantages of lamellar keratoplasty are real if vascularization is deep. The trophic action of the graft is better than that of keractectomy without the thinning of the cornea produced by the last-named operation.

"*3. Therapeutic lamellar transplants.* The trophic action of keratoplasty is one of the most important facts which can be verified either immediately after the operation or later in postoperative observation. The improvement in the diseased cornea around the transplant is sometimes so striking several months after the operation that an observer not acquainted with the preoperative condition of the patient would sincerely doubt there had been any indication for operation in such cases.

"In the disease of the graft (where postoperative turbidity of the graft led to more or less pronounced opacification) Filatov advocated the performance of small lamellar keratoplasties around the transplant. I have systematically studied the treatment by lamellar keratoplasty of some serious corneal diseases at the height of their development rather than after cicatrization of the lesions has taken place as in optical keratoplasty.

"Therapeutic lamellar transplants may be performed either at the periphery or in the center of the cornea depending upon the case and the seriousness of the lesion. These therapeutic grafts are indicated in all forms of chronic or recurring keratitis when all the usual methods of treatment have failed; when the center of the cornea is threatened, or there is fear of perforation.

"The best results are obtained in keratitis due to neurotrophic viruses, especially herpetic keratitis and keratitis of herpes zoster, in syphilitic and tubercular keratitis and those of undetermined etiology.

"I have also operated on some cases of

traumatic, ulcerative, and postoperative dystrophic keratitis. In three cases, I have been able to close a corneal perforation. In another case, I have cured a corneal ulcer with hypopyon where local and systemic treatment had failed. Recurring pterygium is a good indication for therapeutic keratoplasty and, using this method, I have cured pterygiums made progressively worse by repeated intervention.

"The operation is without danger and only in 10 percent of the cases have I been forced to perform a second keratoplasty in order to get some results. Improvement in the lesion is often very rapid, in 15 days or a month. The pain stops, inflammatory signs and ulcers recede, and clearing up of the cornea is often very marked. Complete cure is obtained in 75 percent of the cases and the remaining are often improved. There are never accidents and no case has been made worse.

"Therapeutic transplants, therefore, are a first-class indication for keratoplasty, almost as interesting if not more so than optical transplants. Therapeutic keratoplasty is, in a way, a real preventative treatment for corneal blindness."

Instruments and Technique

Stimulated by the reports of our French colleagues which so greatly extended the possibilities for keratoplasty, I started performing lamellar keratoplasties in a variety of corneal lesions following the methods used by Paufique and Sourdille. These operations were also performed at The Institute of Ophthalmology of Columbia-Presbyterian Medical Center for the purpose of pooling our material in an attempt to draw conclusions based on the experience of different surgeons and a larger group of cases. The techniques used were essentially those described by Paufique and Sourdille for the partial and total lamellar keratoplasty.

In order to be able to regulate the depth of penetration both in the cornea of the host and in that of the donor, I devised the trephine illustrated in Figures 1 and 2. This trephine has a stop which can easily and accurately control the depth of penetration into the cornea from 1/10 or even 1/20 to several millimeters. The trephine is made in sizes from 4 to 12 mm. Sizes 5 to 9 or 10 mm. are used for partial lamellar grafts and sizes 10 to 12 mm. for total lamellar keratoplasties. All sizes can be mounted in the handle of an Elliot trephine (fig. 1-C).

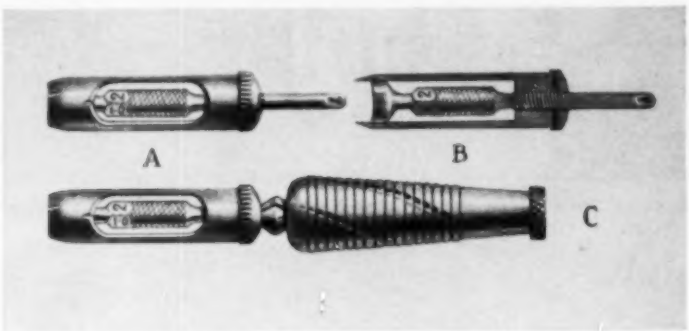

Fig. 1 (Castroviejo). Castroviejo's special trephine with micrometric regulation.

The other special instruments used for the operations are: a knife which can be a cataract knife, a Lundsgaard or Desmarres knife or a knife made with razor-blade material, such as the one illustrated in Figure 3, and special scissors such as those I use for circular penetrating grafts and keratectomies (fig. 4).

The method for partial lamellar kerato-

plasty, mainly advocated by Paufique, is carried out as follows: The trephine, set to the required depth of penetration, generally no more than 0.5 mm. in order to avoid perforation of the cornea, is used to outline the leukomatous area to be excised from the cornea of the host (fig. 5-A). A suture inserted at the edge of the leukomatous outlined circle helps start the dissection with the aid of a knife (fig. 5-B). The dissection of the leukoma is continued with blunt scissors in the same plane of dissection so that a portion of cornea of even thickness may be removed without penetrating into the anterior chamber (fig. 5-C).

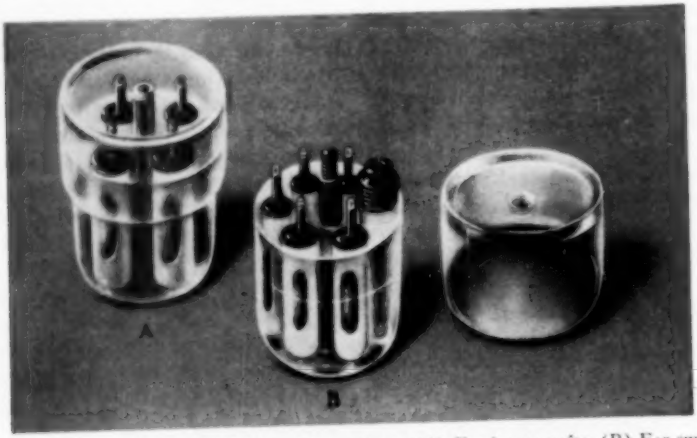

Fig. 2 (Castroviejo). Set of Castroviejo's special trephines: (A) For large grafts. (B) For smaller grafts.

Fig. 3 (Castroviejo). Castroviejo's special utility knife made with razor-blade material.

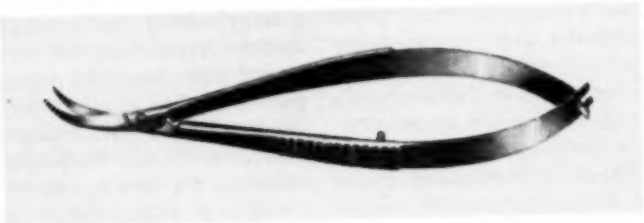

Fig. 4 (Castroviejo). Castroviejo's special blunt keratoplasty-keratectomy scissors.

After this first dissection, if enough opacity should remain which might interfere with a successful result, an attempt should be made to excise all or as much as possible of this by dissecting more corneal lamella.

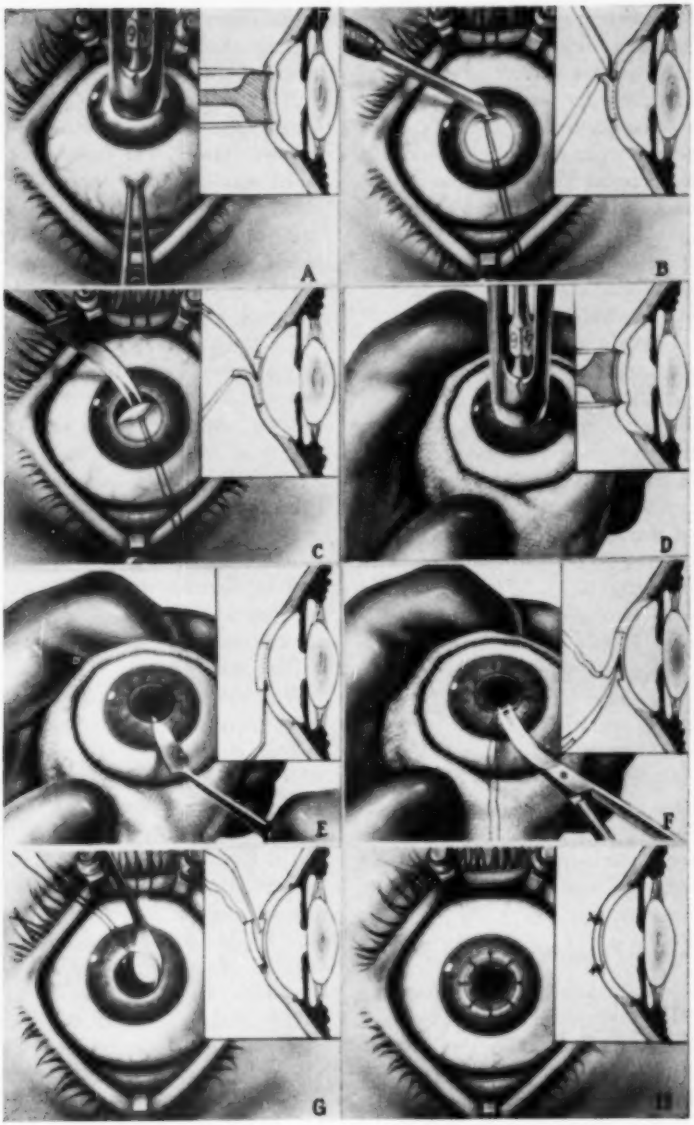

Fig. 5 (Castroviejo). Technique for partial lamellar keratoplasty.

The lamellar graft is obtained from the donor eye in a similar manner (fig. 5-D, E, and F), using a keratome instead of a knife to start the dissection of the graft. The graft is then placed in the eye of the host (fig. 5-G) and secured in position by border-to-border sutures (fig. 5-H).

This technique differs from that of Paufique mainly in two points: first, in the manner of dissecting the leukoma and the graft.

Paufique uses a knife exclusively and I prefer blunt scissors such as my keratectomy scissors, which permit an easy and good dissection, minimizing the tendency to perforation. This often occurs when only a knife is used, particularly in dissecting deep opacities in the vicinity of Descemet's membrane. Second, border-to-border sutures instead of cross sutures are placed over the graft to secure it in position. I found that border-to-border sutures hold the graft more securely in place than sutures crossing over the graft, especially when the grafts are large.

The technique for total lamellar keratoplasty, mainly advocated by Sourdille, is almost identical with that of the partial lamellar transplant, the only difference being the size of the graft. The trephine outlines the leukomatous area to be excised (fig. 6-A), the dissection of the leukoma is begun with a knife (fig. 6-B) and completed with blunt scissors (fig. 6-C). In a similar manner, the graft is obtained from the donor's eye (fig. 6-D, E, and F), placed in the eye of the host (fig. 6-G), and fastened in position by border-to-border sutures (fig. 6-H). Here again, the operation differs from Sourdille's in the use of scissors instead of a knife to complete the dissection of the leukoma and the graft and in border-to-border suturing instead of cross suturing over the graft to secure it in position. The sutures still remaining are removed around the 14th postoperative day.

Results

These results of lamellar keratoplasty are based on the pooled material of The Institute of Ophthalmology of Columbia-Presbyterian Medical Center and my own. Since May, 1948, we have been able to assemble 51 cases of lamellar transplants. Twelve cases have not been included in this survey because they were operated within the last four months. This is too short a period of time in which to form an opinion on the final outcome of the graft. The remaining 39 cases were observed postoperatively from 5 to 13 months. Eleven cases were operated at The Institute of Ophthalmology and I performed the other 28 operations.

Of these 39 patients, eight or 20 percent to date have shown improvement over preoperative vision. The best visual acuity obtained was 20/30 in one patient, 20/40 in two cases, and less than 20/50 in the rest. In 26 cases, or 66 percent, vision remained unchanged after surgery. In the remaining 13 patients, vision is poorer than before the operation.

The cases were selected to include a variety of corneal conditions in order to determine the indications for this type of keratoplasty. Among the cases studied were superficial leukomas in the pupillary area, corneal dystrophies, corneal opacities with descemetocele, superficial vascularized leukomas extending over the whole cornea, recurrent vascularized opacities after superficial keratectomy combined with postoperative irradiation, and eyes in which a previous penetrating optical keratoplasty had resulted in a nebulous graft.

With the exception of one case operated as an emergency for a rapidly progressing corneal ulcer leading to perforation, with descemetocele already present, all operations were performed for optical purposes.

The best results were obtained with the partial lamellar grafts in cases of superficial opacities in the pupillary area where the graft was surrounded by healthy corneal tissue (fig. 7), in Groenow's dystrophy, and in a case of penetrating graft with superficial cloudiness. In three cases of primary epithelial edema of the cornea (Fuchs's dystrophy), the disease recurred in the graft. The dystrophy also invaded the graft in a case of fatty infiltration of the cornea. In densely vascularized corneas, the graft developed vascularization and became cloudy. In cases in which a previous keratectomy performed for the treatment of vascularized leukoma had resulted in the recurrence of the opacity with more or less vascularization, the lamellar graft also became quite cloudy

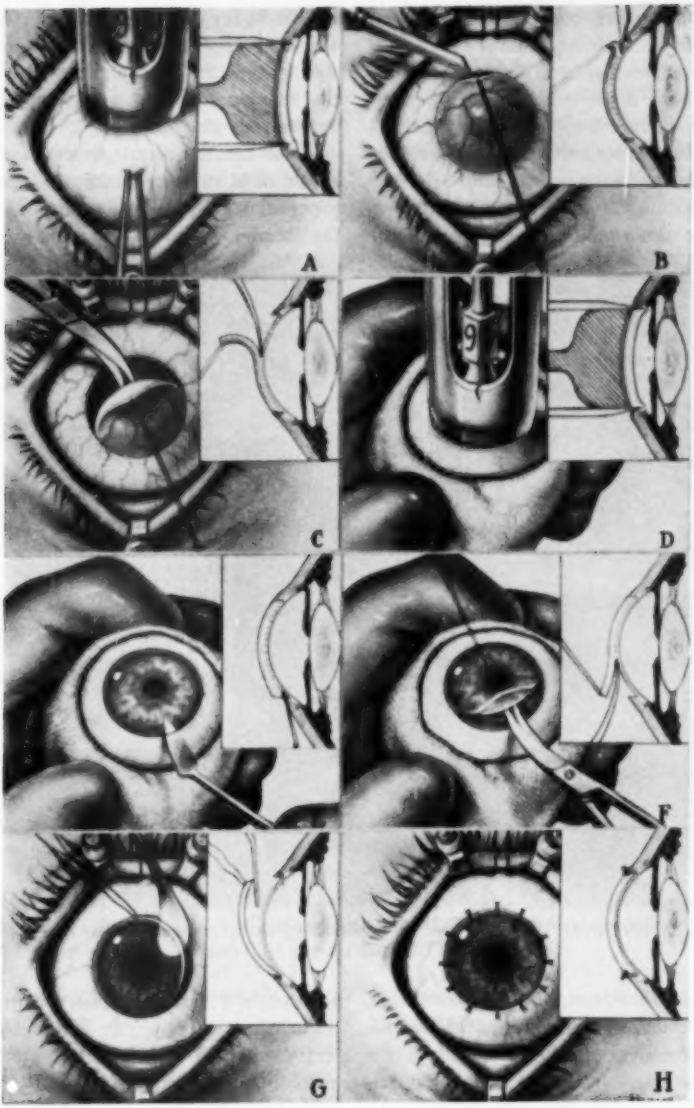

Fig. 6 (Castroviejo). Technique for total lamellar keratoplasty.

with more or less pronounced interstitial and superficial vascularization.

A study of these cases of partial lamellar keratoplasty seems to indicate that the lamellar graft offers the highest probability of success for optical purposes under the same conditions as for the penetrating keratoplasty; that is, when the transplant is surrounded by healthy corneal tissue. It is likely to become more or less opaque when sur-

rounded by unhealthy cornea, particularly in the presence of vascularization.

When the lamellar grafts remain fairly clear, they have approximately the same appearance to the naked eye as a clear penetrating graft, but under critical focal illumination, particularly with the slitlamp and corneal microscope, it is always possible to detect some abnormalities at the base of the

at least in my experience, the perfectly clear, sparkling appearance often seen in the penetrating type of transplant, which accounts for the better visual acuity obtained with penetrating grafts.

Total lamellar keratoplasty gave the best result in a case in which the opacity was superficial and the graft was in contact at the border with a normally vascularized

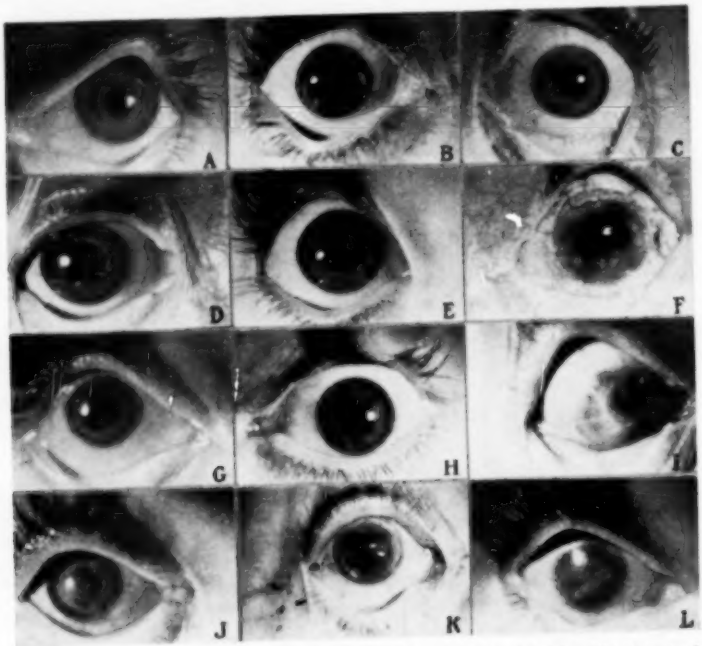

Fig. 7 (Castroviejo). Photographs of eyes operated by partial or total lamellar keratoplasty. (A to J) Partial. (K and L) Total.

cicatrization in the form of slight cloudiness, granular opacities, and little folds which seem to have developed as a result of the operation and are not remnants of the opacity of the host. When the opacities are remnants of the host's cornea, they are located deeper than the base of cicatrization, while the opacities resulting from the operation remain limited to the base of cicatrization of the graft.

In general, it may be stated that even the clearest partial lamellar graft never attains,

limbus. In a case of primary corneal edema (Fuchs's dystrophy), the dystrophy recurred in the graft. In superficially vascularized corneas such as observed after burns, as well as after some keratectomies, the graft cicatrized well during the first 2 or 3 weeks and then developed interstitial vascularization which, after receding, left the graft more or less cloudy and useless for visual purposes.

In one case of densely vascularized leukoma, a total lamellar keratoplasty was purposely performed as a preliminary operation

and resulted in a very nebulous graft. Three months afterward, in accordance with the suggestions given by Paufique and Sourdille, a partial penetrating keratoplasty was carried out, followed by complete opacification of the graft. Possibly the failure was caused by the fact that not enough time had elapsed after the first operation or else the bed furnished by the first graft was unsuitable for a partial penetrating transplant.

Other complications besides vascularization which defeated the success of the operations for visual purposes, especially in total lamellar keratoplasties, were corneal abscesses between the graft and the cornea of the host; also corneal ulcers of the neuroparalytic variety with slow-healing tendencies. Another complication observed, particularly in total lamellar grafts, was granular opacities at the base of the transplant, often combined with striations in the cornea of the host and folds in Descemet's membrane.

In none of the cases of total lamellar keratoplasty was final vision sufficient to be of practical value. Perhaps the period of observation was not long enough to record the final condition of the graft and determine the suitability of the graft either as an optical procedure or as a preliminary operation to improve the tissue of the host, as suggested by Paufique and Sourdille.

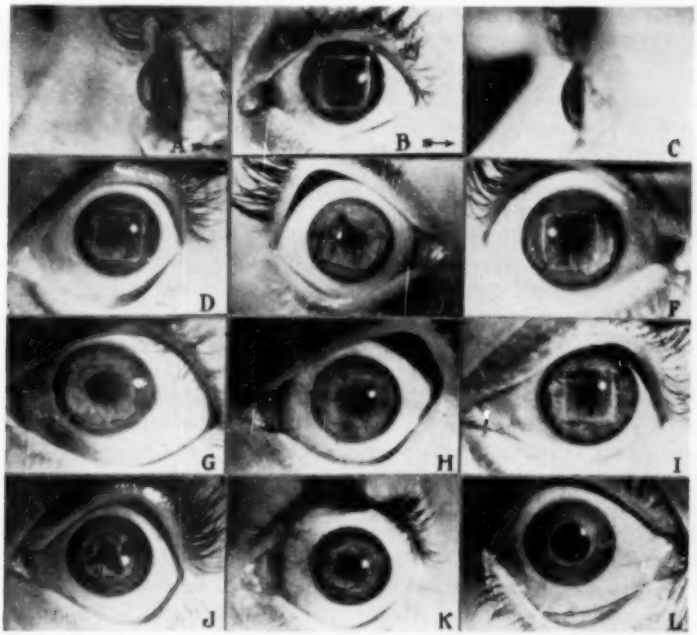

Fig. 8 (Castroviejo). Photographs of eyes operated by partial penetrating keratoplasty. (A) Profile of keratoconus before operation. (B and C) After operation. (D to I) Square transplants. (J, K, and L) Circular transplants.

Conclusions

In the light of my limited experience with partial and total lamellar keratoplasties and my more extensive one with penetrating keratoplasties and keratectomies,[9] I shall now attempt briefly to give the indications for these different procedures.

Lamellar keratoplasty does not give as

brilliant results as penetrating keratoplasty (fig. 8). Vision of 20/20 or better, not infrequently obtained with penetrating keratoplasty, is the exception with the lamellar graft. Unquestionably, lamellar keratoplasty is far safer than the penetrating one and avoids many unpleasant complications, such as iris incarceration and prolapse, injury to lens, secondary glaucoma, and endophthalmitis. For that reason, therefore, I feel that, although lamellar keratoplasty, as a rule, offers lower visual acuities than penetrating keratoplasty, it is the procedure of choice in one-eyed individuals, in aphakia, and, in general, in all superficial corneal opacities, particularly those affecting the pupillary area with good surrounding cornea.

In very unruly patients, children or adults, where it is reasonable to suppose that because of poor coöperation the postoperative recovery will be stormy with great danger of severe complications, lamellar keratoplasty is also the method of choice, whenever applicable. It should also be preferred when the operation is performed mainly for cosmetic improvement. Lamellar keratoplasty should be used for the removal of superficial opacities developed in a penetrating graft. Corneal dystrophies of the Fleischer, Groenow, and Haab-Dimmer types, as well as other dystrophies not involving the deeper layers of the cornea, will benefit by lamellar keratoplasty, although penetrating keratoplasty is likely to give better vision.

In the presence of unhealthy cornea surrounding the graft, such as superficial vascularization after burns, the partial lamellar graft is very likely to become vascularized and cloudy. In these cases, a partial superficial keratectomy followed by postoperative irradiation either as a final operation or as a preliminary operation to a penetrating keratoplasty will be likely to give better results than the lamellar graft. In cases of dense fatty degeneration involving the pupillary area, the dystrophy will almost certainly recur in the lamellar graft unless the whole affected area can be excised. Therefore, such cases will also do better with partial, superficial keratectomy combined with postoperative irradiation to prevent corneal vascularization if the dissection extends to the limbus.

In Fuchs's epithelial dystrophy (primary corneal edema), the dystrophy invariably recurs in the lamellar graft. In advanced keratoconus, penetrating keratoplasty is preferable to the lamellar one. In interstitial keratitis, the best results will be obtained by the penetrating graft; the lamellar graft should be used, however, when the patient has only one eye or in anticipation of performing a penetrating keratoplasty afterward if visual results are disappointing.

In descemetocele, penetrating keratoplasty is preferable because a lamellar graft will offer only structural improvement, since the deep opacities surrounding the descemetocele cannot be easily excised and, for optical purposes, a penetrating graft will eventually be required. In the same category as descemetocele can be included adherent leukoma. This will first require preliminary treatment to free the iris from the cornea and later should be followed by a penetrating keratoplasty which permits the removal of the opacity involving the whole corneal thickness.

In extensive corneal opacities with superficial vascularization requiring a total lamellar graft, Paufique and Sourdille state that the graft can be used to improve the condition of the eye anatomically in order to increase the chances of success for a final partial lamellar or penetrating keratoplasty. In my experience, total lamellar keratoplasty performed in these unfavorable corneas has always resulted in cloudy grafts and these grafts were not found to be better beds for a final lamellar or penetrating keratoplasty than the original unfavorable corneal opacity.

Until conclusive evidence with abundant statistical data has been presented proving the value of the lamellar graft in these unfavorable eyes, it will be best to treat them by the simpler procedure of keratectomy, combined with postoperative irradiation,

either as a final operation or as a preliminary one to a penetrating keratoplasty.

Likewise, the advantages of lamellar keratoplasty over keratectomy combined with postoperative irradiation, with or without the use of buccal mucous graft, for the treatment of recurrent pterygium, will have to be established by the comparison of the two procedures in a sufficient number of cases, taking into consideration both the avoidance of recurrence and final postoperative appearance.

It has already been stated that lamellar keratoplasty is far safer than penetrating, but it is also true that keratectomy is an easier procedure and obviates the need for donor material which is not always easily available. Therefore, if keratectomy offers a fair chance for visual improvement, in cases in which a choice is possible, it would seem to be the preferred operation (fig. 9).

I have had no experience with lamellar keratoplasty as a therapeutic agent for the treatment of active corneal conditions and, therefore, I am unable to comment on its value. It seems, however, that the use of lamellar keratoplasty would be justified whenever there are no other effective means for treating certain corneal conditions such as Mooren's ulcer, recurrent herpetic, rosacea, and neuroparalytic keratitis. In ulcus rodens, the graft can be used, of course, when all other local and systemic treatment have failed. However, if there is the slightest chance that the ulcerative process can be brought under control by conservative means, I believe there is no justification for performing a lamellar keratoplasty on the assumption that this procedure will lessen

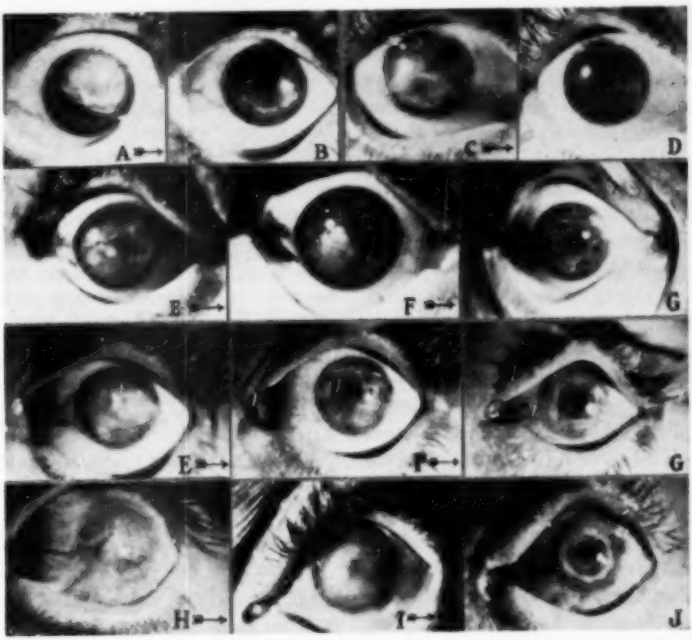

Fig. 9 (Castroviejo). Photographs of eyes operated by keratectomy or by keratectomy and partial penetrating keratoplasty. (A and B) Before and after partial superficial keratectomy. (C and D) Before and after total superficial keratectomy. (E) Before operation. (F) After partial superficial keratectomy. (G) After final keratoplasty. (H) Before operation. (I) After total superficial keratectomy and conjunctival plastic surgery. (J) After final keratoplasty.

the amount of cicatricial tissue or shorten the recovery.

It is not uncommon to observe a very dense leukoma, which immediately after cicatrization of a severe ulcer with very poor vision would seem to require a keratoplasty for improvement, clear up so much in a few months with such an increase in visual acuity that a corneal transplantation is no longer justified.

On the same order, I doubt whether it is necessary to perform a corneal transplantation for therapeutic purposes in an active case of interstitial keratitis in order to shorten the evolution of the disease or prevent dense corneal haziness, because it is a rather frequent occurrence to observe severe cases of interstitial keratitis subside, leaving the eye with complete or almost complete transparency of the cornea and very good vision.

These remarks about lamellar keratoplasty should be considered only a preliminary and very incomplete contribution, since it is very obvious that the group of cases studied is far too small and the period of time of some of the cases observed is too short to be able to draw definite conclusions as yet. It is very possible that, when the cases already operated are studied over a longer period of time, the final results may improve and my views will change. Another possibility for consideration is what might be termed my prejudice in favor of penetrating keratoplasties and keratectomies because of my more extensive experience with these procedures than with lamellar grafts. It is very likely that, when I have acquired as much experience in the handling of lamellar grafts as Paufique and Sourdille, I may find there are more indications for these operations and ultimately prefer them to penetrating keratoplasties and keratectomies.

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ACKNOWLEDGMENT

The French School of Ophthalmology, through the splendid pioneering work of Magitot and Morax, and now with that of Paufique and Sourdille, has made one of the finest contributions to the field of keratoplasty. Their work has restimulated my interest in lamellar grafts which I had already given up as useless for visual purposes. I shall continue to use lamellar grafts whenever applicable in order to gain more knowledge about their indications. At present, although my results have not closely approached those of Paufique and Sourdille, I sincerely hope that when my experience increases in quantity of operations and length of follow-up, my results will more nearly approximate those of our French colleagues, to whom I now wish to acknowledge my deepest gratitude for the courtesies they extended to me when I visited their services.

I would also like to acknowledge with thanks the collaboration of Dr. Gerard DeVoe of The Institute of Ophthalmology of Columbia-Presbyterian Medical Center for evaluating the results of our pooled material, which is the basis of this study, as well as for his discussion of this subject when Dr. Paufique and Dr. Sourdille gave their presentation before the Section of Ophthalmology of the New York Academy of Medicine.[10]

REFERENCES

1. Castroviejo, R.: Proc. Staff Meet., Mayo Clin., **6**:417-418 (July) 1931.
2. ———: Proc. Staff Meet., Mayo Clin., **6**:669 (Nov.) 1931.
3. ———: Am. J. Ophth., **24**:1-20 (Jan.) 1941; **24**:139-155 (Feb.) 1941.
4. ———: Tr. Am. Ophth. Soc., **43**:324-330, 1945; Am. J. Ophth., **29**:1081-1089 (Sept.) 1946.
5. ———: Am. J. Ophth., **31**:1375-1383 (Nov.) 1948.
6. ———: Tr. Am. Ophth. Soc., **46**:127-152, 1948.
7. Paufique, L., Sourdille, G. P., and Offret, Guy: Les Greffes de la Cornée (Kératoplasties), Paris, Masson & Cie, 1948.
8. Paufique, L.: Personal communication, May, 1949.
9. Castroviejo, R.: Tr. Am. Ophth. Soc., **41**:222-240, 1943; Arch. Ophth., **32**:11-22 (July) 1944.
10. DeVoe, G.: Discussion of Dr. Paufique and Dr. Sourdille's presentation on lamellar keratoplasty before the Section of Ophthalmology of the New York Academy of Medicine, April, 1949.

A NEW SLITLAMP APPARATUS

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Slitlamp apparatus exists today in numerous modifications. In general they can be grouped into two classes which may be designated as the Gullstrand type and the Comberg type. These two types are essentially distinguished by the following characteristics:

In the Gullstrand type the slitlamp swings about an axis which is far removed from the patient and is close to the physician. An advantage of this arrangement is that, by means of a long radial arm, the slitimage can easily be led in a lateral direction across the eye. However, sidewise exchange of slitlamp and microscope is inconvenient, and also the slitimage is not automatically located in the field of view of the microscope.

In the Comberg type, slitlamp and microscope move about a single common axis of rotation, which, with proper placing of the patient, passes through his pupil. An advantage of this arrangement is that the slitimage constantly lies in the field of view, and that an object in the anterior portion of the eye can conveniently be illuminated from various directions with a stationary slitimage solely by swinging the slitlamp about its axis of rotation. The sidewise exchange of lamp and microscope is accomplished with little effort. Much more inconvenient is the lateral movement of the slitimage as required for observation in transparent* light.

The two original slitlamp types,[1] named after Gullstrand and Comberg,† formed the prototypes for numerous later constructions.[2] A decisive advance was not achieved until production of the well-known Goldmann[3] slitlamp apparatus.‡ This embodies the common axis of rotation of the Comberg type through the pupil of the patient, and the swinging of the lamp about an axis of the Gullstrand type far distant from the patient.

Without going further into details regarding this well-known and in many respects excellent apparatus, two characteristics deserve special mention because they signify a fundamental improvement over all preceding models. These are a vertical extension by means of which slitlamp and microscope are simultaneously adjustable in height and, in the new model, a steering lever by means of which the entire apparatus is precisely moved horizontally in any desired direction.

My new slitlamp apparatus§ to be described herein belongs, in respect to the axis of rotation, to the Comberg type. On the other hand, it bears unmistakable features which call to mind the Goldmann apparatus, such as the joint adjustment in height and the steering lever for precise horizontal movements, even if these elements here are not parts of the apparatus itself but of the instrument table. Essential, however, are two new functions. These are the ability to swing the slitlamp in front of the microscope from one side to the other without interruption of observation, making possible new fields of investigation; and an arrangement for slitlamp microscopy of the posterior vitreous humor and the fundus, in an optically correct and manually most simple manner.

INSTRUMENT TABLE

The large examination instruments of the ophthalmologist, such as the slitlamp apparatus, ophthalmoscope, retinal camera, perim-

* Professor Vogt called this mode of illumination "regredientes Licht" and adds, "There is for this expression no equivalent expression in any language." In English the word "transparent" light was chosen and has been used for many years. Its meaning is known to all slitlamp microscopists.

† Manufacturer: Carl Zeiss, Jena, Germany.

‡ Manufacturer: Haag-Streit, Bern, Switzerland.

§ Manufacturer: Zeiss-Opton, Oberkochen, Germany.

eter, refractionometer, and so forth, have certain features in common in respect to adjustment with the eye of the patient. It must be possible to move each of these instruments with precision in a horizontal plane as well as in a vertical direction. Fundamentally these movements should be carried out only by the instrument, not by the patient. For

Fig. 1 (Littmann). Zeiss-Opton slitlamp apparatus on instrument table in normal working position.

economic considerations, it is advantageous to transfer provisions for these movements once and for all to the instrument table upon which each of the instruments is placed, instead of incorporating them into each individual instrument.

Figure 3 shows an instrument table designed for this purpose. The table top is adjusted simultaneously with the headrest to the sitting height of the patient by turning the hand wheel (1). Precision adjustment of the table top with reference to the stationary headrest, and therewith also the patient, is achieved in a vertical direction by means of the elevation head (2) and in a horizontal plane by means of the steering lever (3). Consequently, any apparatus standing upon the table can be adjusted to the patient's eye in any of the three coördinates of space.

The adjusting mechanisms are easily operated since the table top rolls upon ball bearings and, furthermore, since a counter spring takes up the weight of the table top and apparatus. By a slight turn, the steering lever, and with it the table top, can be arrested in any position.

The foot of the apparatus, extending somewhat beyond the edge of the table facing the patient (fig. 1 and fig. 3), runs upon the table top on rollers, and the metal table edge engages a horizontal groove in the foot. As a result, the instrument can easily be moved but the movement is restricted to a lateral direction. This motion serves to direct the apparatus as required upon one or the other eye of the patient.

To compensate anatomic anomalies, the chinrest is raised or lowered in the usual manner by means of a head (fig. 3-4). The entire headrest can be moved toward or away from the apparatus by means of a head beneath the table top. These two controls, the latter of which is seldom needed, serve to place the patient. They do adjust the apparatus itself and are not operated during the course of an examination. Once his position is established, the patient remains completely undisturbed.

Beneath the table top are the main connections for supplying electric current, transformers and switches.

Slitlamp apparatus

Figure 1 depicts the Zeiss-Opton slitlamp apparatus in position for standard application of slitlamp microscopy of the anterior eye.

Corneal microscope

The binocular corneal microscope of this new slitlamp apparatus has three improvements over the hitherto known models, namely:

1. An exceptionally large working distance (119 mm.) which provides sufficient

space for freely swinging the slitlamp past the front of the microscope.

2. A convenient change of magnification. Just by turning the drum (5), five different magnifications can be obtained. The customary change of objectives is dispensed with. Oculars can be changed, but there is no need for doing so. With the supplied ×12.5 oculars, the following magnifications are available in rapid sequence merely by turning the drum (5) ×6, ×10, ×16, ×25, and ×40.

3. The working distance remains the same for all magnifications. Adjustment of the focus is not required after changing the magnification.

The optical principle employed is shown in Figure 2. The microscope possesses a single large objective (O_1) into the focus of which is brought the object to be observed. The two openings of the diaphragm (D) cut out two pencils of rays which enter the paired objectives (O_2). Between O_1 and O_2 pass two pencils of parallel rays which are collected in the focal plane (FV) of objectives (O_2). In this image-plane, therefore, arise two images of the object; these in turn are observed with the two oculars (OC).

Since there is a parallel course of rays between O_1 and O_2, it is possible to insert there a pair of Galilean telescopes, as indicated by GT in Figure 2. The fundamental course of the rays is not changed thereby. Only the size of the image is changed, and that in accordance with the magnification of the two Galilean systems. However, the Galilean systems can also be inserted into the path of the rays in reverse, so that these systems exercise a reducing rather than a magnifying effect. There result then three different magnifications—without GT, with GT in magnifying position, and with GT in reducing position.

In the present construction the Galilean telescopes are housed in the drum (5). In the same drum there is a second pair of such systems which in the same manner provides two further magnifications, so that, in all, five magnifications are brought about. Figure 2 indicates that the working distance for all magnifications is the same—if the Galilean systems are correctly constructed so that the parallel entering rays are still parallel when they leave the system.

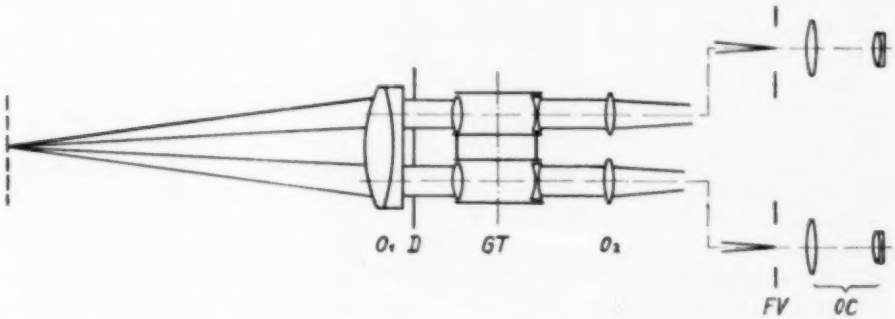

Fig. 2 (Littmann). Optical system of the corneal microscope. (O_1, O_2) Objectives; (GT) Galilean telescope in parallel path of rays; (D) objective diaphragm; (FV) field of view diaphragm; (OC) oculars.

Slitlamp

The slitlamp shown in Figure 1 and Figure 3 consists of a lamp housing and the illuminating shaft (6) which contains the illuminating optics together with the reversing prism (7).

The prism is so narrow that binocular observation is not disturbed even if the slitlamp stands precisely in front of the microscope. It is, therefore, possible to illuminate the eye centrally and, at the same

time, to look binocularly into the eye past both sides of the prism. In consequence, even with narrow pupils, it is easy to penetrate to the posterior lens surface and beyond into the vitreous humor. Only occasionally, when the prism (7) happens to lie precisely in front of one of the objective diaphragm openings (D) (fig. 2) is observation temporarily monocular, never is it completely interrupted. Since the slitimage maintains its position in the eye while the lamp swings through its arc, new observational possibilities arise in so far that the angle between observation and illumination direction can be continuously reduced from 90 degrees to zero.

The slitlamp is further provided with a lever (8) for adjusting the width of the slit, and a lever (9) for adjusting the length of the slit, as well as with a device (10) for lateral displacement and, on the same axis a device (11) for depth displacement of the slitimage.

The two last-mentioned devices (10 and 11) have the following function: In the normal operating position, marked by a catch, the slitimage lies exactly in the focus of the corneal microscope. When the slitlamp itself, as well as the entire apparatus, is displaced, the microscope is always directed upon the center of the slitimage in the eye and sharply focused.

However, if one wishes to observe in transparent light, it is necessary to move the slitimage laterally out of the field of view of the microscope. This is brought about by means of the device (10), which adjusts the upper part of the lamp shaft and its reversing prism by rotating it about its axis. The lateral movement suffices to carry the slitimage across the entire iris.

By adjusting the device for depth movement (11), the slitimage is moved in the direction of depth out of microscopic focus. This movement can be utilized to illuminate simultaneously a larger region of the vitreous humor. Naturally the microscope is then no longer sharply focused upon the slitimage itself, but upon the side of the light wedge extending into the eye.

The slitlamp is also provided with two knobs (12 and 13). Turning (12) introduces a ground-glass disc, (13) a red-free filter into the path of rays. The ground-glass disc is intended for general illumination of the eye, above all for testing the pupillary reaction to light. For this the slitlamp with closed slit is brought into central position. Since the width of slit is adjusted by means of a lever, it is possible to open it to its full width instantly and thereby ascertain the reaction of the pupil to the incidence of light. The red-free filter is intended for red-free ophthalmoscopy. Occasionally it also is of use in the observation of fine capillaries and streaming of blood corpuscles.

Manipulation of the apparatus

The manipulative devices are so arranged that the two hands of the physician execute a minimum of movements during an examination. Especially avoided is the troublesome shifting from one adjustment screw to another. All superfluous adjustments have also

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Fig. 3 (Littmann). Slitlamp apparatus on instrument table with fixation lamp and telescope supplement for slitlamp microscopy of the posterior vitreous humor and for ophthalmoscopy. (1) Hand wheel for vertical adjustment of the entire table top including headrest; (2) head for fine adjustment of elevation; (3) steering lever for horizontal fine adjustment; (4) head for vertical adjustment of the chin (to compensate anatomic anomalies); (5) drum for setting five different magnifications of the binocular corneal microscope; (6) lamp shaft; (7) illuminating prism; (8) lever for adjusting width of slit; (9) lever for limiting the length of the slit; (10) coaxial adjustment for lateral movement of the slitimage (for observation in transparent light); (11) adjustment for depth movement of the slitimage; (12) lever for inserting a ground-glass disc; (13) lever for inserting a red-free filter; (14) head for clamping the mutual positions of corneal microscope and slitlamp; (15) cap of the lamp housing; (16) carrier for the Hruby lens; (17) Hruby lens; (18) fender; (19) fixation lamp.

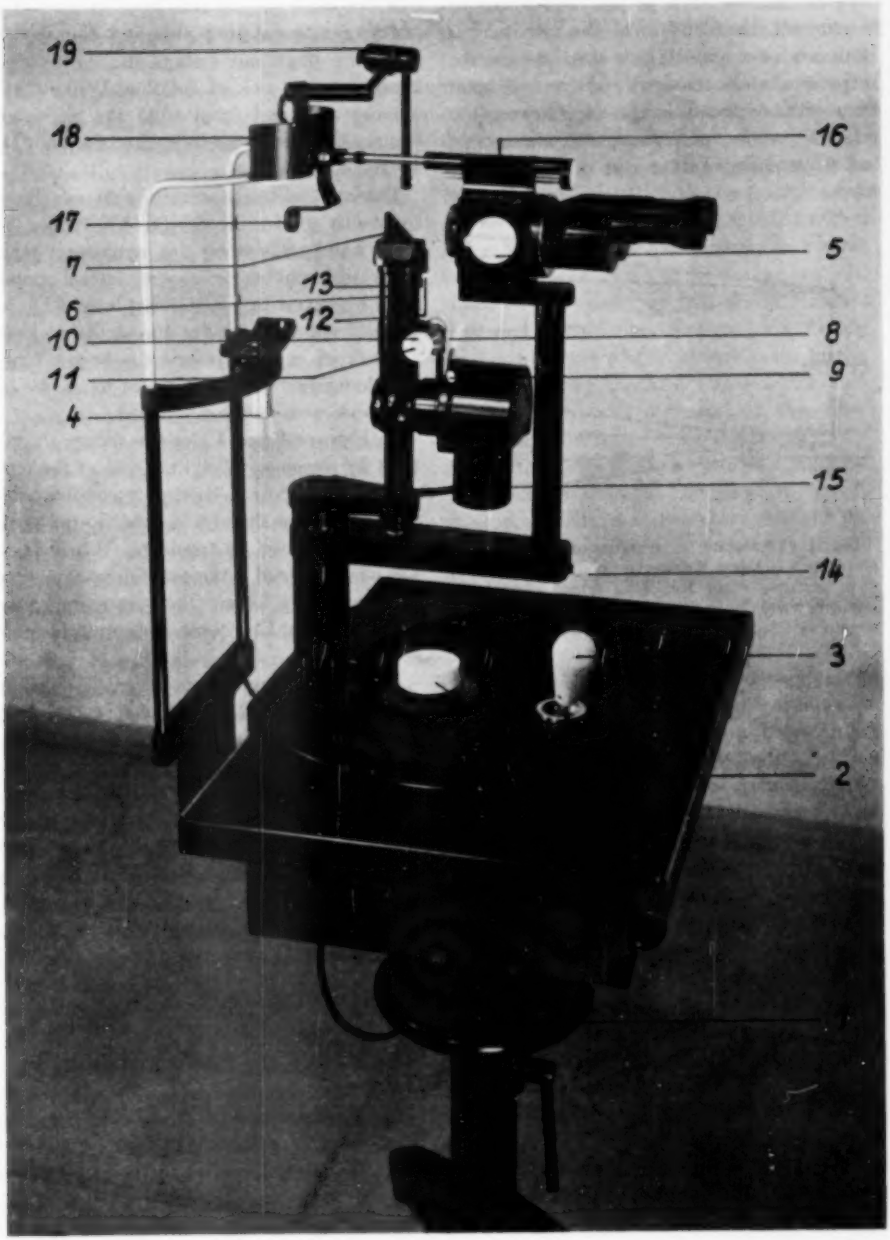

Fig. 3

been eliminated, such as the adjustment in height and the focusing of the microscope. Both are now unnecessary since the microscope is already centered and focused upon the middle of the slitimage. If, however, the relative position of slitimage to microscope has to be changed, it can be done by means of the devices (11 and 10). In normal usage

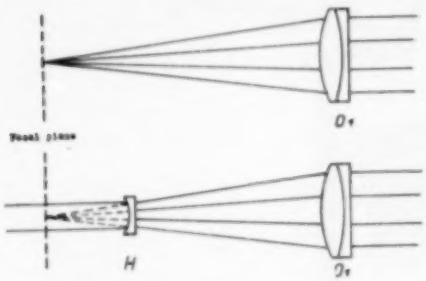

Fig. 4 (Littmann). Conversion of a microscope objective (O_1) into a telescope objective by means of a negative front lens (H) which images the infinitive virtually in the object plane of the microscope.

precise focusing of the point of interest is accomplished by means of the steering lever (3) located on the instrument table. By means of this, slitimage and microscope are simultaneously focused. The same lever effects lateral adjustment of the image.

All important adjustment heads are symmetrically arranged. The steering lever (3) and the elevation-fine adjustment (2) of the instrument table are equally accessible to either hand. The frequently called for adjustment of slit width is also symmetrical in the sense that the slit is closed when (8) is vertical and is opened when (8) is moved either to the right or left. The drum head (5) for changing magnifications and the devices (11 and 10) of the slitlamp are all duplicated on the right and left sides of the instrument. Only the seldom-used adjustment for length of slit (9) is accessible from one side only.

The best position for the physician's hand is shown in Figure 1. It is immaterial whether the right or left hand is used. By pressing against or pulling on the device (10) the physician swings the entire slitlamp about its axis of rotation. Without removing the hand from (10) the physician can readily reach with individual fingers (11, 10, 8, 12 and 13).

During the entire examination one hand constantly guides the device (10), while the other hand rests upon the instrument table ready to focus or to control lateral movement by means of the steering lever (3); or occasionally to reach for the elevation head (2) to correct the adjustment in height. Only for changing the magnification must one of the hands pass to the drum (5).

In Figures 1 and 3 also are shown a knob (14) by means of which the arm of the corneal microscope can be rigidly coupled with the arm of the slitlamp in any desired position of the two instruments. When knob (14) is tightened, lamp and microscope turn simultaneously about their common axis. With loosened knob each is separately movable.

All manipulative knobs are made of white plastic so that, in a darkened room, they stand out plainly from their surroundings.

The slitlamp does not require any adjustment, not even when the electric bulb, contained in cap (15), is changed. This cap is attached to the lamp housing by means of a bayonet lock. The bulb is mounted in a prefocus bayonet-type base and is inserted into the bayonet socket, thereby assuring proper alignment of filament.

Supplementary equipment for slitlamp microscopy of the posterior vitreous humor and for ophthalmoscopy

Recently significance has been given to slitlamp microscopy of the posterior regions of the eye by the investigations of Hruby.[4] For this method special accessories for the apparatus herein described have been developed by me (fig. 3). The arrangement consists of a carrier (16) for the Hruby lens (17), which is mounted upon the cor-

neal microscope, as well as a fender (18) and a fixation lamp (19) mounted upon the headrest.

The Hruby lens serves to nullify the effect of the optical system of the examined eye in order that the posterior parts of the eye may become accessible to slitlamp microscopy, without entailing the discomfort of a contact glass otherwise employed for this purpose.

The optical system of the examined eye, at least with an emmetropic eye, forms an image of the fundus at infinity. In order to magnify an infinitely distant object use is made of a telescope, as is well known. Therefore, for this work one does not require a microscope but a telescope.

To convert a microscope into a telescope it is only necessary to place a negative lens in front of the objective so that the focus of the negative lens on the image side lies in the plane of the object (fig. 4), for the infinitely distant forms a virtual image in the focal plane on the image side of a negative lens. Consequently, this image can be seen sharply with the microscope if the focal plane of the negative lens coincides with the object plane of the microscope.

In the present case the Hruby lens has a refractive power of about −58 diopters. It forms, in accordance with the foregoing explanation, together with the two objectives O_1 and O_2 of Figure 2, a telescope objective. It is obvious that a telescope objective consisting of several lenses can form satisfactory images only if the individual lenses are centered one to another. Therefore, the Hruby lens must be centered with the microscope objective O_1, that is, its optical axis must coincide with the optical axis of O_1.

This is assured only if the Hruby lens is mechanically connected with the microscope, and not with the patient or the headrest. In the latter case readjustment of the lens would be required with every movement of the slitlamp apparatus or of the patient's eye, and this would occupy the very hand of the physician which should be attending to the slitlamp.

The Hruby lens as a component of the microscope automatically follows its lateral movements and swing. It may not, however, follow the forward and backward movements of the microscope since the eye of the patient would be endangered thereby. Therefore, the holder for the lens rests against a fender which is mounted upon the headrest.

The end of the holder is provided with a roller which is kept continuously in contact with the fender by a spring mechanism. The shape of the fender is such that a constant distance is maintained between the Hruby lens and the eye of the patient as the microscope is swung about in scanning the fundus in a horizontal direction. In this manner slitlamp microscopy of the posterior regions of the eye is of the utmost simplicity.

In order to scan the fundus of the eye in other directions, it is necessary that the patient executes appropriate changes in the direction of his vision. Following Hruby's suggestion, this is best accomplished by means of a movable luminous fixation mark (19) presented to the other eye.

For binocular viewing of the fundus the previously mentioned possibility of simultaneously looking to the right and left of the illuminating prism (7) of the slitlamp, standing exactly in front of the microscope, is highly advantageous, since illumination and observation, as in an ophthalmoscope, take place in the same direction. Therefore, neither a reduction prism nor a specially angled monocular corneal microscope is required.

Naturally the fundus image is not free of reflections. However, with the present arrangement, the disturbing reflection on the front surface of the Hruby lens has been eliminated. To this end the front surface has not been made in the usual convex shape but in a plane. In addition, the surface is somewhat inclined so that its reflected light cannot enter the microscope. There remain then only the less disturbing reflections from the posterior lens surface and from the cornea.

For red-free ophthalmoscopy the previous-

ly mentioned red-free filter can be inserted into the path of the illuminating rays by means of the knob (13).

Since the pencil of illuminating rays also passes through the Hruby lens, the image of the slit in this method of examination likewise always lies in the object plane of the microscope. Therefore, with the Hruby lens as well, the slitimage is constantly sharply seen without special adjustments.

Summary

A new slitlamp apparatus is described, which offers the following advantages over any known apparatus:

1. By turning a knob, five different magnifications are obtained with the binocular corneal microscope without change of objectives and oculars, and without changing the working distance.

2. The slitlamp can be swung past the corneal microscope without interruption of observation.

3. In the central position it is possible to observe binocularly past the right and left of the slitlamp and thus see particularly far into the eye media, even when the pupils are narrow.

4. A simple supplementary equipment, which converts the corneal microscope into a binocular telescope, permits slitlamp microscopy of the posterior vitreous humor, as well as binocular ophthalmoscopy in white and in red-free light, in an optically correct and manually simple fashion.

5. The apparatus requires no adjustments whatsoever.

6. Slitimage and microscopic field of view are automatically constantly focused upon one another.

7. The location of the manipulative parts essentially facilitates use of the apparatus.

Zeppelin Strasse, 13.

The slitlamp apparatus herein described was designed by Mr. B. Mueller, whom I wish to thank for his coöperation.

References

1. Henker, O.: Ztschr. f. ophth. Optik., **4**:75, 1916.
Comberg, W.: Klin. Monatsbl. f. Augenh., **91**:577, 1933. (German patent No. 441-405, dated April 2, 1926.)
2. Fertsch, F.: Ztschr. f. ophth. Optik., **30**:1, 1942.
3. Goldmann, H.: Klin. Monatsbl. f. Augenh., **91**:494, 1933. (German patent No. 620-541, dated May 8, 1933.)
4. Hruby, H.: Ophthalmologica, **115**:290, 1948.
Lemoine and Valois: Bull. Soc. franç. d'Opht., **36**:366, 1923.

Ophthalmic Miniature

A gentleman informed me that he always found a difficulty in studying with a binocular microscope in that he could never get the two glasses to blend. . . . By this and other circumstances he discovered that there was a focal difference in his eyes. That one eye was far-sighted, while the other was near-sighted. He showed me a pair of spectacles he wears for reading purposes, in which the one glass is made for the far sight, while the other is a plain glass, the left eye being near-sighted and consequently requiring no aid from spectacles with which to read.

W. S. Palmer: Focal differences of the eyes,
Science Gossip, **9**:257, 1873.

EYE CHANGES IN A MARSUPIAL EXPERIMENTALLY INFECTED WITH KALA-AZAR AND TRYPANOSOMIASIS*

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In accordance with the usefulness of the common Australian phalanger or possum (Trichosurus vulpecula) already noted (Bolliger, 1940), these readily procurable marsupials have further been employed in investigating the pathogenicity of a large group of microörganisms. The possibility that marsupials might become reservoirs of pathogens endangering man and livestock has also been examined.

Among the protozoal infections investigated was kala-azar or leischmaniasis, a tropical disease repeatedly encountered in Indian seaman arriving in Sydney during World War II. Ordinary laboratory animals are practically immune to this tropical disease, but the local possum was found to be highly susceptible and to develop eye lesions in addition to the usual visceral pathologic processes. Bolliger and Backhouse (1948) have reported on the general aspects of experimental kala-azar in Trichosurus vulpecula and the present communication deals with the eye lesions found to occur both in this disease and in South American trypanosomiasis (Chagas's disease).

Literature

As already pointed out, eye lesions in human kala-azar have received scant mention. Elliott (1920) in his treatise on tropical ophthalmology does not mention them. Duke-Elder (1937) briefly refers to a rare Leishmania keratitis. Cesario de Andrade (1942) described a rare Leishmania keratitis occurring in Brazil, which has an appearance "similar to the parenchymatous or interstitial keratitis of hereditary syphilis." He also referred to a more frequent type of ulcerative keratitis which showed a direct relation to cutaneous lesions in the vicinity of the eye. In his recent book on eye manifestations of internal diseases, Tassman (1946) mentions leishmanial conjunctivitis and leishmanial keratitis but points out that the uveal tract is not seriously involved.

Similarly, animals infected with Leishmania, naturally or experimentally acquired, do not seem prone to develop eye lesions. Such lesions as do occur seem to be mainly confined to the cornea and the corneosclerotic junction and are frequently secondary to skin lesions in adjacent structures. Again no serious damage to the uveal tract has been described.

No references could be found to eye manifestations in experimental South American trypanosomiasis. An acute keratitis has occasionally been met with in man suffering with Chagas's disease (Tassman, 1946).

Technique

Kala-azar was originally transmitted to a few phalangers by inoculating them with the blood or cultures prepared from the blood of infected Indian seamen. The infection was then transmitted to other phalangers. Over 95 percent of the inoculated animals became infected with leishmaniasis. The acquired disease was of a chronic malignant nature and killed the inoculated possum within 3 to 40 months.

Twenty-five pairs of eyes were examined at intervals of a few weeks from the day of the inoculation. Atropine was instilled an hour before examination. Anesthetics were not usually required, the animals being sufficiently quiet to permit a scrutiny of the fundus.

After death, a number of eyes were cleared with cedarwood oil and examined with a slitlamp. Most of the eyes obtained at post mortem were sectioned and stained with hematoxylin and eosin.

* From the Gordon Craig Research Laboratories, Department of Surgery, The University of Sydney.

THE NORMAL EYE

Walls (1942), in his book on the vertebrate eye, repeatedly refers to a marsupial which he calls "cuscus, Trichosurus vulpecula." The scientific name of cuscus, a different animal though belonging to the same genus as Trichosurus vulpecula, is Spilocuscus nudicaudatus. From the writings of Walls it is not clear which of the two species Trichosurus vulpecula or Spilocuscus naudicaudatus is meant, and some of the descrip-

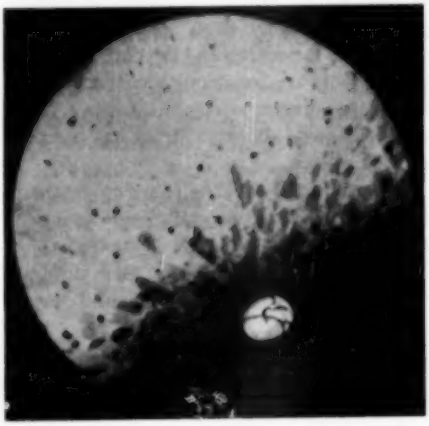

Fig. 1 (Bolliger and Macindoe). Ophthalmoscopic appearance of the normal fundus of the phalanger or possum (Trichosurus vulpecula). (From a painting by S. Woodward-Smith.)

tions of the eyes in question do not conform with our observations on normal Trichosurus vulpecula. For these reasons some of the relevant features of the eye of the phalanger or possum are now recorded.

The eye of Trichosurus vulpecula possesses a nictitating membrane which occasionally interferes with its examination. The eyeball is an almost complete sphere. The cornea, however, is slightly more curved than the rest of the globe, and is a relatively large structure, measuring about 80 percent of the diameter of the eyeball, which is approximately 1.2 cm. The cornea is of uniform thickness and possesses a well-defined Descemet's membrane but Bowman's membrane is absent. The fibrous sclera is devoid of cartilage.

The pupil is not a slit as stated by Walls but is round or slightly oval and retains this form even under maximum contraction in intense light. The lens is only of moderate size, its diameter being about 6.7 mm., that is, about half of the eyeball. The flatness index is 1.3.

The sclera is about 0.3 mm. thick and consists of fibrous tissue only. The choroid layer is only half as thick as the sclera and is heavily pigmented. The ciliary body and the iris are likewise heavily pigmented.

To this extent the possum eye resembles a human eye and the structures described are definitely mammalian in character. The retina, however, has characteristics which distinguish it from higher mammals and which, in part at least, may be considered vestiges of its evolutionary ancestors such as reptile and monotremes.

Macroscopically the whole of the retina, when hardened in formalin, consists of a thin layer which possesses a silvery sheen. On ophthalmic examination of the living specimen (fig. 1) and confirmed by slitlamp observations of the cleared eye, the retina is found to be divided into two parts. These are a nonpigmented superior semicircle and a deeply pigmented inferior semicircle. The disc is situated in the pigmented inferior semicircle near the margin separating the two areas. There are no retinal vessels visible, as in the fundus of the human eye for example. The optic disc is frequently characterized by a vestigial conus papillaris (Bergmeister papilla) with a bunch of vessels projecting into the canal of Cloquet. In some instances a definite hyaloid artery was seen to be present.

O'Day (1936) described double cones containing oil droplets in both members, occurring in the receptive visual elements of the retina of all Australian marsupials examined. It is not impossible that this unusual arrangement has some bearing on the experimental results to be described.

Findings in experimental kala-azar

One or several days after a single parenteral inoculation of Leishmania donovani, the organism of kala-azar, there was a catarrhal conjunctivitis in the majority of phalangers infected. This conjunctivitis usually cleared up within a few weeks, although sometimes persisting for several months .

Subsequent events were influenced considerably by the nature and course of the infection. If the visceral infection took a fairly acute course and the animal died within a few months, no marked eye lesions were seen and the most impressive results were obtained in chronic kala-azar of one year's duration or more. In these later experiments the eyes showed little change for the first few months after which the sequence of lesions appeared.

Curiously enough, the most constant of these was a very faint opacity at the posterior pole of the lens, an incipient posterior polar cataract. Eighty percent of all the infected animals examined, irrespective of age or sex, developed this opacity earlier or later in the course of the disease. In some instances this localized cloudiness disappeared for a while but always returned later and became more extensive and in some instances progressed to complete cataract.

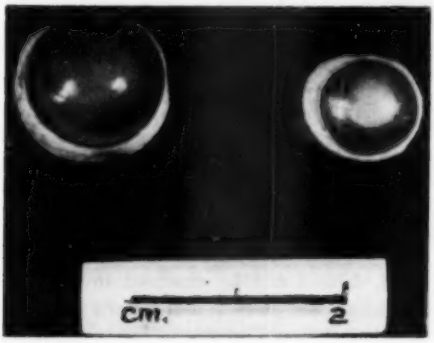

Fig. 2 (Bolliger and Macindoe). (Left) Cataract in a female possum infected with kala-azar when just pregnant. (Right) The eye of her baby, born with congenital cataracts, died when half grown.

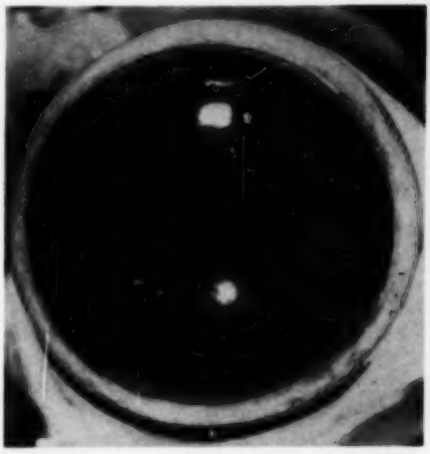

Fig. 3 (Bolliger and Macindoe). Early iridocyclitis in ocular experimental kala-azar.

This was supplemented by a localized anterior cataract which developed after the posterior opacity and was less extensive. In the absence of any other reason, these opacities of the lens should be attributed to changes in the composition of the aqueous humor and should be considered as typical complicated or secondary cataracts.

Evidence of uveal lesions primary to the cataract was not lacking. Choroiditis was frequently seen. Admittedly in its early stages the diagnosis of choroiditis was sometimes doubtful, because the distribution of pigment varies considerably in different animals. In its acute phase, however, gross disturbances in the retinal pigment underlying a haze of the vitreous were frequently seen before or at the time when the posterior polar cataract became established. Again in the chronic or healing stages it was difficult to be sure that one was looking at a patch of choroiditis and not just another variation in the distribution of pigment. In some cases, however, this was so definite as to admit no doubt (fig. 2).

Cyclitis was seen usually in a more advanced stage when the cataract frequently made examination of the fundus difficult or impossible. As in human beings, it was diag-

Fig. 4 (Bolliger and Macindoe). Later phase of iridocyclitis.

nosed by the presence of keratic precipitates which were found to vary in size from very fine punctate spots to large white precipitates, the so-called mutton-fat keratic precipitates (fig. 3).

Cyclitis was observed in the eyes of about 20 percent of the possums chronically infected. The incidence may have been higher,

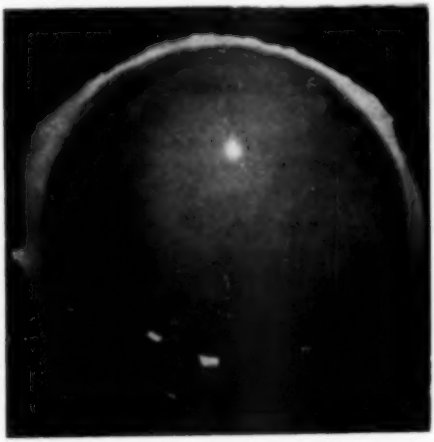

Fig. 5 (Bolliger and Macindoe). Large keratic percipitates and interstitial keratitis in ocular experimental kala-azar. (The final stage.)

but binocular magnification of only two times was used with a hand torch and it is possible that some cases were missed.

Iritis also appeared comparatively late and was predominantly of the mild plastic type with little ciliary congestion but with posterior synechia in any diameter or in a complete ring. In very advanced specimens iris bombé was also seen. Seclusion or occlusion

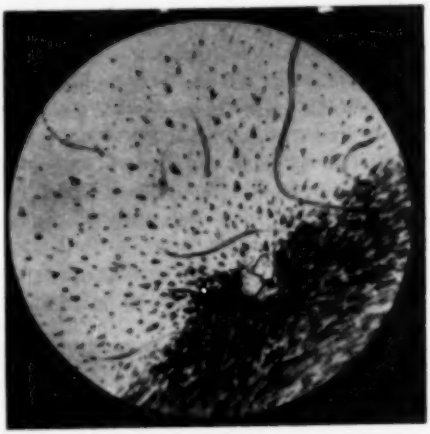

Fig. 6 (Bolliger and Macindoe). Appearance of the retina of a phalanger in comparatively early kala-azar. The "streaks" in all probability are engorged retinal or choroidal vessels. (From a painting by S. Woodward-Smith.)

of the pupil finally led to secondary glaucoma. This could be observed in eyes removed at post mortem and cleared in cedarwood oil. Primary glaucoma has not hitherto been seen in animals infected with kala-azar.

On account of the unusual structure of the retina of Trichosurus vulpecula, retinopathy, which under the circumstances described was certain to occur, was difficult to establish. However, in many instances an appearance somewhat similar to angioid streaks seen in human beings was noted. This appearance may have been due to destruction of the retina and exposure of the retinal or choroidal vessels (figs. 4, 5, and 6). In one or two instances there were also signs of hemorrhages and of detached retina.

In several animals, pathologic changes in the optic disc, observed before the onset of severe cataract and keratitis, were papilledema and optic atrophy. This, for example, was seen in an animal with a severe Leishmania infection of the brain. On post-mortem examination, the optic nerves of this possum showed a dense cellular infiltration with many parasitized cells (fig. 7). Consequently it was felt that the ophthalmoscopic diagnosis of optic neuritis was valid.

The development of interstitial keratitis

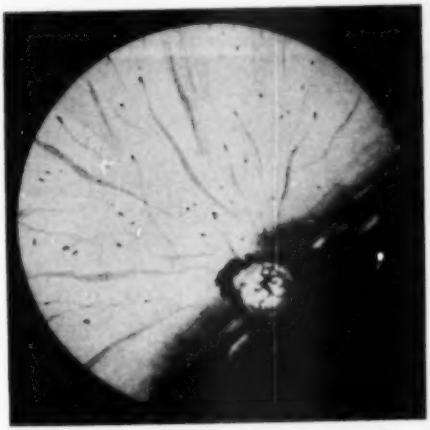

Fig. 7 (Bolliger and Macindoe). Choroiditis and "retinitis" in a phalanger infected with kala-azar. Note the unusual distribution of pigment and streaks in the unpigmented half of the fundus. (From a painting by S. Woodward-Smith.)

was noticed in about one fifth of the infected animals. The onset may be as early as four to five months after infection. In the early stages the cornea showed slight haziness and the vessels of the limbus were congested. Then new blood vessels grew toward the center of the cornea. Simultaneously the haziness of the cornea increased till its whole aspect had the well-known ground-glass appearance.

Findings in Chagas's disease

Trypanosoma cruz, a parasite related to Leishmania donovani, is the cause of South

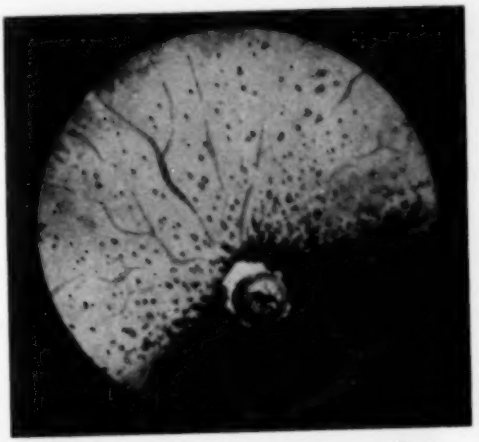

Fig. 8 (Bolliger and Macindoe). Circumpapillary choroidal atrophy, "retinitis," and hyaloid artery in moderately advanced experimental kala-azar.

American trypanosomiasis or Chagas's disease. This infection was transmitted to phalangers by intraperitoneal or intramuscular inoculation of the organism. All the inoculated animals contracted Chagas's disease and 60 percent of them died within 23 to 32 days after inoculation. The cause of death was always heart failure, and tissue damage was mainly confined to the heart muscle. In the

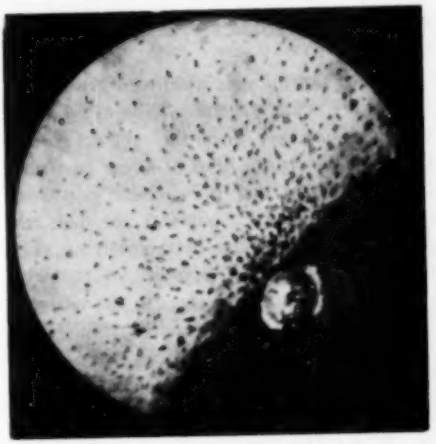

Fig. 9 (Bolliger and Macindoe). Choroiditis, papilledema, and circumpapillary choroidal atrophy in experimental kala-azar. (From a painting by S. Woodward-Smith.)

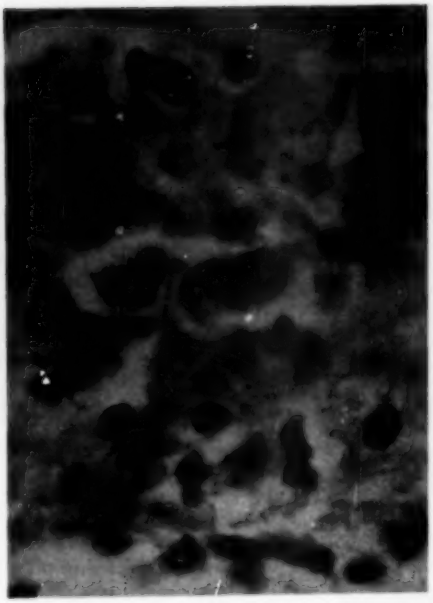

Fig. 10 (Bolliger and Macindoe). Parasitized macrophages in the optic nerve of a phalanger infected with kala-azar. (×1,200.)

surviving animals, no parasites could be demonstrated in blood or tissue, and the blood of these phalangers had lost the power to infect other animals (Backhouse and Bolliger, 1950).

Two of six animals examined toward the end of the acute stage showed lens opacities differing, however, from the cataract seen in kala-azar infection. One of these two phalangers had in one eye minute points of opacity scattered throughout the lens together with an opacity of the vitreous. The other lens showed a ring-shaped posterior opacity and punctate floaters in the vitreous. The second specimen exhibited ring-shaped opacities on the posterior aspect of both lenses.

Four of the six specimens which survived the acute stage for one month or more had definite ocular abnormalities. The right optic disc in one possum presented the picture of primary glaucoma. The disc of the left eye appeared to be normal but there was marked evidence of choroiditis. In two other phalangers, posterior ring-shaped cataracts were noted. In one animal, additional lateral displacement of the markedly opaque lens yielded an unusual picture (fig. 8). The displacement of the lens was first noted four months after infection. No evidence of trauma was seen.

In addition to the lesions mentioned which were somewhat different from those seen in kala-azar, there was also evidence of choroiditis and retinitis with or without lens opacities.

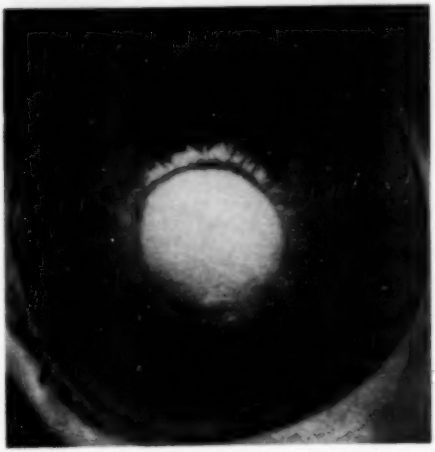

Fig. 11 (Bolliger and Macindoe). A late phase—a ripe cataract, chronic glaucoma with atrophic iris.

Discussion

One might theorize that the infection of kala-azar in all probability affects Trichosurus vulpecula for the first time since its marsupial ancestors arrived in Australia about 100 million years ago. Consequently this species was probably unable to develop immunity toward Leishmania infection, a disease which may affect almost any organ of the body including the eye.

However, as compared with higher mammals, the observed frequent incidence of eye infections in visceral kala-azar cannot be ex-

plained at present except on an assumed high vulnerability of the marsupialian eye which in all probability is not confined to attacks by Leishmania donovani. In the present communication it has been shown that infection with Trypanosoma cruzi may also produce eye lesions, though the general course of the infection (Chagas's disease) differs markedly from that of kala-azar. Eye lesions in phalangers have also been encountered after experimental infections with Mycobacterium tuberculosis.

It must be emphasized that definite lesions of the inner eye were never encountered in numerous control animals kept in the laboratory over comparably long periods. This observation would exclude any factors such as nutrition or mode of confinement being responsible for the pathologic eye changes described. In general the lesions resemble eye manifestations of internal diseases of man, particularly syphilis.

The ophthalmic lesions produced experimentally with great regularity in phalangers have so far rarely been reproduced in any other experimental animal and it is remarkable that the eye of the phalanger, an arboreal nocturnal animal whose existence depends largely on good eyesight, is so markedly vulnerable to kala-azar inoculated parenterally.

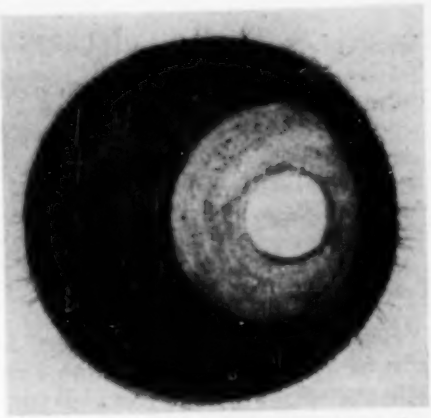

Fig. 12 (Bolliger and Macindoe). Eye showing displaced lens and ring-shaped cataract in a phalanger which had survived trypanosomiasis infection. (From a painting by S. Woodward-Smith.)

Summary

Kala-azar transmitted to a marsupial, the common phalanger or possum (Trichosurus vulpecula), produces a chronic progressive disease associated with severe eye lesions.

The observed ocular changes, such as interstitial keratitis, uveitis, retinitis, and optic neuritis, resemble those seen in man in internal diseases and particularly syphilis.

In addition, progressive cataracts mainly of the posterior polar type were observed in the great majority of the affected eyes.

South American trypanosomiasis (Chagas's disease) transmitted to the phalanger produces an acute disease with a recovery rate of 40 percent. Eye lesions, seen in the late acute and recovery stages, differ somewhat from those seen in experimental kala-azar.

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References

de Andrade, C.: Interstitial and ulcerous keratitis in leishmaniasis. Arch. Ophth., **27**:1193, 1942.

Backhouse, T. C., and Bolliger, A.: In process of publication.

Bolliger, A.: Trichosurus vulpecula as an experimental animal. Australian J. Sc., **3**:59, 1940.

Bolliger, A., and Backhouse, T. C.: Transmission of kala-azar to the Australian marsupials, Trichosurus vulpecula and Pseudochirus laniginosus. Tr. Roy. Soc. Trop. Med., **41**:797, 1948.

Duke-Elder, W. S.: Textbook of Ophthalmology, London, Kimpton, 1937, v. 2, p. 1949.

Elliott, R. H.: Tropical Ophthalmology. London, Oxford Univ. Press, 1920.

O'Day, R. T.: The retina of the Australian mammal. M. J. Australia, **1**:326, 1938.

Tassman, I. J.: The Eye Manifestations of Internal Disease. St. Louis, Mosby, 1946.

Walls, J. L.: The Vertebrate Eye. Bloomfield Hills, Mich., The Cranbrook Institute of Science, 1942.

HEPARIN AND UVEITIS*

An experimental study

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Introduction

Heparin is used primarily in clinical medicine for its anticoagulant properties. Very little practical use has been made of its other less well-known characteristics. Heparin is a powerful inhibitor of many biologic reactions in which proteins participate.[1] The growth of cells in tissue culture is modified by heparin and their metabolism is profoundly altered.[2] A partial explanation for this is the ability of heparin to combine with amino groups by virtue of its own acid radicals.

It has been known for many years that heparin modifies anaphylactic reactions. Kyes and Strauser[3] demonstrated the protective action of heparin against shock in pigeons sensitized to sheep serum. Williams and his associates[4] and Macht[5] confirmed the protective action in guinea pigs sensitized to horse serum. Gregoire[6] has recently shown that heparin inhibited the typical Arthus phenomenon in rabbits sensitized to horse serum.

While there are differing opinions as to the etiology of uveitis, there is extensive clinical and experimental evidence that hypersensitivity plays an important role.[7] One can produce a uveitis in animals by sensitizing the animal and subsequently introducing the antigen into the eye. Nicolle and Abt[8] found that an intense uveitis was produced in rabbits by this method using horse serum.

In our experience the intensity of the ocular response is in proportion to the sensitivity of the animal as measured by the titer of the serum antihorse precipitins. For this reason, we have selected the method of Nicolle and Abt to study the effects of heparin on experimental uveitis. The ocular response is uniform and the control is reliable when the animals are grouped according to their relative precipitin titers.

In a previous study it was shown that heparin entered the intraocular fluid only after the capillary permeability had been disturbed.[9] It was also shown that if heparin were placed in the eye its presence could be detected for approximately 24 hours. Intraocular inflammation provides the necessary increase in capillary permeability for heparin to enter the eye.

In an earlier study it was found that heparin administered to hypersensitive rabbits prior to the injection of antigen protected the animals against uveitis.[10] This immediately raised two questions: (1) What will heparin do if it is administered simultaneously with antigen; (2), and more important from a therapeutic standpoint, what will heparin do if it is administered after the antigen has entered the eye?

Experiment

Eighteen albino rabbits were sensitized to horse serum and on the basis of their relative sensitivities, as measured by the antihorse serum precipitin titer, they were divided into three groups, each group having similar precipitin titers (table 1).

In Group I all right eyes and two left

* From the Wilmer Ophthalmological Institute of The Johns Hopkins Hospital and University and the Department of Bacteriology, Johns Hopkins University School of Medicine. Aided by a grant from the National Institute of Health.

eyes were injected with horse serum while the remaining four left eyes were injected with saline. In Group II heparinized* horse serum was injected into both eyes of each rabbit, while in Group III both eyes were injected with horse serum alone. Subsequently, the animals in Group III were heparinized systemically.

TABLE 1

GROUPING OF RABBITS USED IN STUDYING THE USE OF HEPARIN IN UVEITIS

Group I Antigen	Group II Heparinized Antigen	Group III Antigen Followed by Heparin
12,800	12,800	12,800
12,800-S	12,800	6,400
6,400-S	6,400	6,400
6,400-S	6,400	6,400
3,200-S	3,200	6,400
1,600	1,600	3,200

The number in the column indicates the anti-horse serum precipitin titers of the rabbits in each group. Group I received horse serum in both eyes, except in those marked S, where saline only was injected in the left eye.

MATERIALS AND METHODS

The technique used for the anterior-chamber injections was as follows: The eyes were anesthetized topically with two-percent pontocaine, and proptosed. A sterile, 25-gauge hypodermic needle, attached to a sterile tuberculin syringe, was directed obliquely through the corneal stroma at the limbus for a distance of 3.0 mm. prior to entering the chamber. One tenth of a cc. of the material being injected was thoroughly mixed with the primary aqueous by moving the plunger of the syringe in and out three times. The needle was withdrawn rapidly with 0.1 cc. of fluid remaining in the syringe. In this manner the original volume of the anterior chamber was not altered. Since the average volume of the anterior chamber of the rabbit is 0.25 cc., 40 percent of the material injected remained in the anterior chamber.

The heparinized antigen used for Group II contained 1.0 mg. of sodium heparin per cc. The technique of heparinization of Group III consisted of giving an intravenous injection of sodium heparin-equivalent to 10 mg./K. of body weight, 45 minutes after the anterior-chamber injection of horse serum. Three hours later a subcutaneous dose of heparin equivalent to 15 mg./K. of body weight was administered. Heparinization by this technique maintained the blood incoagulable for the first nine hours and produced some elevation of the clotting time for a total of 12 hours.

RESULTS

The eyes were examined at 1, 5, 7, 12, 24, and 48 hours following the anterior chamber injection and were graded by the degree of reaction of the conjunctiva, anterior chamber, and iris. A numerical value was given according to the degree of reaction observed. A reaction was graded: 3, if it was severe; 2, if moderate; and 1, if mild. The conjunctival reaction was graded on the basis of chemosis, hyperemia, and discharge. The anterior-chamber reaction was graded on the basis of cloudiness and exudate, while the iris reaction was graded according to the degree of hyperemia and thickening. An eye showing maximal reaction would have a total numerical value of 9.

For the purpose of analysis the eyes of rabbits fell into four groups:

a. Eyes injected with normal saline, no heparin (4 eyes).

b. Eyes injected with antigen, no heparin (8 eyes).

c. Eyes injected with heparinized antigen (12 eyes).

d. Eyes injected with antigen, animal heparinized subsequently (12 eyes).

The reactions observed in each of these groups were totalled. The reaction observed in the eyes that were injected with saline was subtracted from the reaction observed in the eyes injected with antigen. This gave a correction for the traumatic reaction following injections. All groups were made statistically equal and the results recorded in terms of percent of total possible reaction (fig. 1).

* The heparin used in this study was generously supplied by Abbott Laboratories.

In the control eyes in which no heparin was employed there was a rapidly developing inflammatory reaction and a severe uveitis which reached a maximum intensity in 24 hours and was still quite severe after 48 hours.

When the antigen was introduced into the eye in the presence of 0.04 mg. sodium heparin, the reaction was markedly inhibited and, at the end of 48 hours, the uveitis had almost completely subsided.

When the antigen was introduced and the animal was systemically heparinized 45 minutes later, the uveitis was much less severe than in the control group.

It will be recalled that heparinization was maintained only for 12 hours. At the 24-hour period it was observed that in Group III there was a slight increase in the severity of the reaction. However, at the end of 48 hours, the uveitis had largely subsided.

It is concluded that heparin has an inhibitory effect on the severity of experimental uveitis, not only when heparin is introduced simultaneously with antigen but also when it is introduced after the antigen has had an opportunity to act on the sensitized ocular tissue. It is interesting also to note that the duration of the uveitis was shortened by the use of heparin. Although the eyes were read and the results recorded only for intervals up to the 48th hour, it was observed that several eyes in the control group were still inflamed at the end of a week, and two eyes in this group had developed secondary glaucoma.

Discussion

The beneficial effect of heparin on experimentally produced uveitis gives us further insight into the mechanism of the effect of heparin on the hypersensitive state. Our previous observations were made only on tissues which had previously been heparinized. It was also observed that heparin in no way prevents the antigen and antibody from combining in vitro.[10]

This ability of heparin to alter the specific reaction capacity of the body cells may possibly be associated with its inhibitory effect on enzyme systems. We have found in a study to be reported that heparin does not become attached to the antigen-antibody complex and for this reason it is felt that heparin must act elsewhere.

It is known that heparin prevents the formation of fibrin, and fibroblastic proliferation is inhibited by heparin. While much remains to be learned, the biochemical potentialities of heparin, or heparinlike substances, should be explored in clinical ophthalmology.

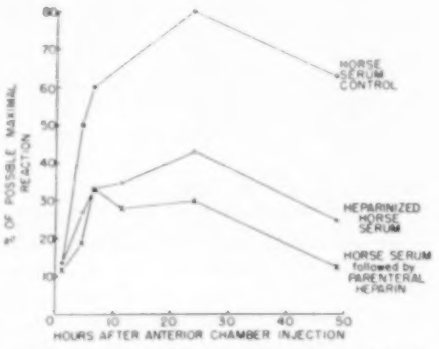
% OF POSSIBLE MAXIMAL REACTION
HORSE SERUM CONTROL
HEPARINIZED HORSE SERUM
HORSE SERUM followed by PARENTERAL HEPARIN
HOURS AFTER ANTERIOR CHAMBER INJECTION

Fig. 1 (Bick and Wood). Results obtained in the experimental study of the use of heparin in uveitis.

Summary

A severe uveitis was produced in sensitized rabbits by the introduction of antigen into the anterior chamber.

When heparin was introduced into the eyes locally and simultaneously with the antigen, the uveitis was markedly inhibited.

When heparin was given systemically after the antigen had been introduced into the eye, the uveitis was markedly inhibited. This inhibition was observed to persist after heparin had been discontinued.

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References

1. Jaques, L. B.: Biochem. J., **37**:189-195 (July) 1943.
2. Zakrzewski, Z.: Arch. f. exper. Zellforsch., **13**:152-175, 1933.
3. Kyes, P., and Strauser, E. R.: J. Immunol., **12**:419-422, 1926.
4. Williams, O. B., and Van de Carr, R. F.: Proc. Soc. Exper. Biol. & Med., **24**:798-800, May 1927.
5. Macht, D. I.: South. Med. J., **37**:402-406, 1944.
6. Gregoire, C.: Arch. Internat. de et de thérap., pharmacodyn., **72**:76-92 (May) 1946.
7. Woods, A. C.: Allergy and Immunity in Ophthalmology. Baltimore, Johns Hopkins Press, 1933.
8. Nicolle, M., and Abt, G.: Ann. Inst. Pasteur., **22**:132, 1908.
9. Bick, M. W.: Am. J. Ophth., **32**:663 (May) 1949.
10. Bick, M. W., and Wood, R. M.: J. Immunol., **64**:357-364, 1950.

RECENT ADVANCES IN OCULAR THERAPY*

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In order to obtain the most effective use of some of the newer therapeutic agents and to avoid unnecessary sensitizations to the various kinds of antibiotics, the following factors should be considered:

1. *Penicillin* is effective chiefly in pathologic conditions of the anterior segment of the eyeball. It is most effective in staphylococcic infections, less in inflammations caused by gonococci, and least in streptococcus infections; it is practically noneffective in pneumococcus infections.[1]

2. The *sulfa drugs:* (A) Sulfanilamide compounds are most effective in streptococcus infections; (B) Sulfathiazole acts effectively in staphylococcus infections; (C) sulfapyridin, in pathologic conditions caused by the pneumococcus; (D) sulfadiazine is equally effective in streptococcus and staphylococcus, as well as in pneumococcus, infections. It is the sulfa drug that penetrates best through the corneo-aqueous barrier. Sulfadiazine is the least toxic of them all. As a result, this drug is the sulfa medication of choice in local treatment or in systemic sulfa therapy. (E) for systemic sulfonamide therapy, a combination of the various sulfa drugs reduces the dosage necessary and also the toxicity considerably.[2]

3. *Streptomycin* is most useful in eye infections caused by the pyocyaneus bacillus and in certain gram-negative bacteria. In addition, streptomycin is useful in cases in which the infection-exciting bacteria have become resistant to the sulfonamides or to penicillin. The value of streptomycin in tubercular eye conditions has not, as yet, been definitely established. Dihydrostreptomycin hydrochloride is less toxic than streptomycin and less likely to cause a toxic optic neuritis.[3]

4. *Bacitracin* has been found to be a useful antibiotic for topical applications in pathologic conditions of the external eye caused by gram-positive organisms.[4]

5. *Aureomycin* is especially effective in virus infections, such as epidemic keratoconjunctivitis, herpes corneae, herpes zoster ophthalmicus, dendritic keratitis, and so forth.[5]

Sensitization

Penicillin, the sulfa drugs, as well as streptomycin, may cause serious sensitization of the eyelids, skin, and conjunctivas, when applied locally. As yet, no cases of sensitization by local bacitracin treatment have been reported. Penicillin, the sulfa drugs, and streptomycin may cause serious systemic sensitization, whether used orally or parenterally. Systemic reactions from

* Presented at the seminar in ophthalmology and otolaryngology, New York Polyclinic Medical School and Hospital, April, 1949.

TABLE 1

ANTIBIOTICS IN OPHTHALMOLOGY

Antibiotic	Indications	
	Bacteriologic	Clinical
I. *Sulfonamides:*		
a. Sulfanilamide	Streptococcic infections, chiefly	Acute conjunctivitis, corneal ulcers, iritis, dacryocystitis, metastatic ophthalmia, trachoma (acute)
b. Sulfapyridine	Pneumococcus infections, chiefly Meningococcus	Pneumococcus conjunctivitis and similar corneal ulcerations, dacryocystitis (acute)
c. Sulfathiazole	Staphylococcus infections, chiefly	Acute and chronic blepharoconjunctivitis, low-grade keratoconjunctivitis, hordeolum, dacryocystitis, dacryo-adenitis, iritis, metastatic ophthalmia
d. Sulfadiazine	Strepto-staphylo-pneumo-meningo-gonococcus	Same indications as for sulfanilamide, sulfapyridine, and sulfathiazole
e. Mixed Sulfa drugs (disulfonols, trisulfonols)	Strepto-staphylo-pneumo-meningo-gonococcus	Same indications as for sulfanilamide, sulfapyridine, sulfathiazole, and sulfadiazine
II. *Penicillin:*	Staphylococcus infections, chiefly. Effective in gonococcus and streptococcus infections and against the Spirocheta pallida	Acute conjunctivitis, corneal ulcers, purulent ophthalmias, gonorrheal ophthalmia of the new-born and adult. Iritis and uveitis. Traumatic and surgical eye infections, endophthalmitis, panophthalmitis, orbital cellulitis, tenonitis, dacryocystitis (acute), dacryoadenitis
III. *Streptomycin:* (dihydrostreptomycin HCl)	Koch's bacillus. Pyocyaneus, strepto- and staphylococcus infections resistant to penicillin	Tuberculosis of conjunctiva and cornea. Tuberculous iritis and uveitis. Pyocyaneus conjunctivitis and corneal ulcers. Sarcoid of the eye
IV. *Bacitracin:* (gramicidin, tyrothricin)	Most gram-positive organisms, including staphylo- and streptococcus resistant to penicillin. Gono- and meningococci. Brucella suis, Bacillus subtilis	Acute and chronic conjunctivitis, blepharoconjunctivitis, keratitis, corneal ulcers, brucellosis, dacryocystitis, hordeolum, and abscess of eye lids
V. *Aureomycin:*	Virus infections of the eyes, hemolytic strepto- and staphylococcus. Pneumo- and gonococcus. Pyocyaneus, diplobacillus, Morax-Axenfeld, meningococcus, Brucella suis	Epidemic keratoconjunctivitis; herpes zoster, herpes simplex of eyelids and cornea. Dendritic keratitis, corneal ulcers, uveitis, syphilis of eyelids, syphilitic optic-nerve atrophy: Impetigo contagiosa, folliculitis and abscess of eyelids, brucellosis

parenteral administration of penicillin can be reduced if the drug is not applied in an oily suspension and if procaine hydrochloride is added to the solution.

The effectiveness of penicillin in local eye treatments can be increased, if it is dissolved in a wetting agent (zephiran) and some procaine is added. The use of a wetting agent increases penetration into the deeper ocular tissues.

The incidence of local sensitivity to topical application of the sulfonamides is much lower than to penicillin. Toxic systemic reactions following sulfonamide, such as vomiting, cyanosis, dyspnea, granulocytosis, crystals in urine, and so forth are, on the other hand, much more serious than systemic reactions to penicillin.

In order to avoid the development of resistance to both penicillin and sulfa drugs, large initial dosages of these agents are preferred to small and prolonged doses. High

TABLE 2

ANTIBIOTICS IN OPHTHALMOLOGY

Antibiotic	Posology	
	Systemic treatment	Local treatment
I. *Sulfonamides:*		
a. Sulfanilamide:	Four tablets of 0.5 gm. at once and then one tablet of 0.5 gm. every four hours for 6–12 days. A sulfa-blood level has to be maintained, 4–8 mg. %	5% ophthalmic solution or 5% eye salve in a stable anhydrous lanolin, cold-cream base
b. Sulfapyridine:	As for sulfanilamide	As for sulfanilamide
c. Sulfathiazole:	As for sulfanilamide	As for sulfanilamide
d. Sulfadiazine:	As for sulfanilamide	As for sulfanilamide
e. Mixed sulfonamides: (disulfonol, trisulfonol)	As for sulfanilamide	No eye preparations available as yet.
II. *Penicillin:*	(a) Either 40,000 units every 2–4 hours until 600,000–800,000 units have been reached; or in syphilis, gonorrhea, etc. a minimum of 4–6 million have been reached (b) Administer 300,000 units of procaine penicillin G. in aqueous solution or in oily solution with procaine and aluminum stearate to avoid unpleasant side reactions (skin rash, etc.). Repeat daily or every other day until 1.5–5 million units have been reached	Penicillin calcium ophthalmic ointment (1,000–5,000 units per gm.) in stable anhydrous nonirritating base. Crystalline penicillin G. potassium ophthalmic ointment (in similar base containing 100,000 units per gm.). For eye drops: 30,000 units per ounce of saline solution with addition of a wetting agent. For tear-sac irrigations: 30,000 units per cc. can be used. For eyecups: 300–5,000 units per cc. in a freshly prepared saline solution. For subconjunctival injections: one cc. containing 5,000 units with some novocain and with wetting agent. In anterior chamber and into vitreous: 500–1,000 units dissolved in 0.1–0.2 cc. of 1.4% saline with novocain and wetting agent.
III. *Streptomycin:* (dihydrostreptomycin HCl)	500,000 to 1 million microgram units daily. Not more than 25–30 gm. altogether	Lately a 5% streptomycin eye ointment has been introduced.
IV. *Bacitracin:* (gramicidin, tyrothricin)	Topical application, only	Bacitracin solution containing 500 units per cc. of isotonic sterile saline or in form of an ophthalmic ointment containing 500 units per gm. in anhydrous lanolin-U.S.P. cold-cream base. Tyrothricin: 0.15–0.45 gm. in 2% alcoholic solution dissolved in 15–30 gm. of distilled water for eye drops or irrigations.
V. *Aureomycin:*	Systemic application 250 mg. tablets by mouth every 2–3 hours for 6–12 days.	Local care. ½% eye drops (25 mg. aureomycin in 5 cc. distilled water with 62.5 mg. NaCl and 25 mg. sodium borate) or 0.1% ophthalmic ointment.

sulfonamide blood levels go hand in hand with high intraocular levels (von Sallmann).

Penicillin not only inhibits the growth of microörganisms sensitive to it but it may also cause bacteriolysis. Therefore, when parenteral injections of penicillin are used in cases of acute uveitis, one must consider the possibility of damage by bacteriolysis, which may aggravate the uveal inflammation and result in a bacterio-toxin-sensitized uvea and

aggravation of the existing acute uveitis; or there may be a flare-up of subacute uveitis.[8] These mishaps do not occur frequently, but we have to be mindful of them.

Indications

In serious eye infections, therefore, such as orbital cellulitis, cavernous sinus thrombosis, endophthalmitis, panophthalmitis, ring abscess of the cornea, and similar dangerous and destructive intraocular inflammations, oral sulfonamide and parenteral penicillin therapy should be instituted at once in large doses and for short duration. It appears that a combination of sulfonamide and penicillin therapy is much more effective in such infections than is the use of either agent alone.

Topical penicillin therapy should be used in these dangerous and serious eye inflammations only if, after 12 hours, the infection has not been controlled by systemic penicillin, and only if the eye condition is serious enough to justify the trauma caused by injections into the eye.

In such cases, not only conjunctival and subconjunctival applications may be given, but injections of this drug into the anterior chamber or into the vitreous are also permissible.

For injections into the anterior chamber in severe infections with hypopyon, 500 to 1,000 units of penicillin dissolved in 0.1 to 0.2 cc. of 1.4-percent saline (or physiologic saline) solution with the addition of one of the following wetting agents—zephiran aqueous solution (1:10,000), aerosol (0.10 percent), phemerol (1:10,000)—and the same amount of two-percent novocain may be used.

For intravitreous injection, a syringe with a 27-gauge needle may be introduced 10 mm. behind the limbus, and 0.1 to 0.2 cc. of crystalline penicillin sodium (5,000 units) dissolved in two-percent novocain, with one drop of adrenalin (1:1,000) and one drop of one of the suggested wetting agents, may be injected slowly. (Some ophthalmologists recommend withdrawal of some of the vitreous first.)

Topical therapy with sulfonamides, penicillin, or bacitracin can be used in ulcerative blepharitis, conjunctivitis, and in corneal ulcers. Inflammations of the iris and ciliary body respond well to topical therapy if they are caused by organisms responsive to the applied antibotics.

Dosage

Sulfonamides

Orally, sulfadiazine or a combination of sulfonamides may be used. Start with four gm. at once for adults, and administer 0.5 gm. every four hours for no more than 5 to 6 days. Watch for signs of toxicity (blood count) and have the sulfa level determined daily. In order to avoid gastric irritations, equal amounts of sodium bicarbonate should be ingested simultaneously. If the urine is acid, give more sodium bicarbonate. The drug is most effective when the urine is alkaline or neutral. The urine should be tested daily.

For local application, use five-percent ophthalmic ointments of sulfadiazine in a lanolin, vaseline, or cold-cream base. Sulfa solutions of the same concentration are instilled 3 to 4 times daily.

Sulfa ointments may produce sensitization of the eyelids and conjunctivas much more quickly than aqueous solutions which are, therefore, becoming more widely recommended. At present, sodium sulfacetimide seems to be the most efficacious aqueous sulfa solution for local use. A 30-percent, well-buffered ophthalmic solution which does not deteriorate for six weeks is prepared by Schering. (This preparation is almost identical to Albucid, an ophthalmic sulfa solution widely used in Great Britain.)

Sodium sulfacetimide has been used for a variety of conjunctival conditions with apparent satisfaction. It is not effective, however, in angular and vernal conjunctivitis.

Penicillin

Parenterally, crystalline sodium penicillin is used with procaine (and aluminum monosterate) in dosages of 300,000 units daily for 3 to 5 days. For smaller doses, 40,000 units are given every four hours intramuscularly in order to obtain a total of 600,000 to 800,000 units. Never discontinue penicillin therapy abruptly; taper off gradually to avoid damage from bacteriolysis.

Ion transfer is a very effective method of causing penicillin to reach the ocular tissues.[7] Penicillin drops and ointments can be used safely for a number of conjunctival and corneal conditions, if their application does not last until local sensitivity develops (5 to 6 days).

The dosage for penicillin eye drops is 30,000 units per ounce of saline solution, with zephiran for the wetting agent (3 to 4 drops to be used every 2 to 3 hours, for 2 to 3 days). For irrigations of infected tear sacs, concentrations of 30,000 units per cc. can be used successfully.

Penicillin may be used in eyecups for corneal affections (3,000 to 5,000 units per cc.). This solution should always be freshly prepared.

Penicillin ointment (1,000 to 5,000 units) may contain either a lanolin-petroleum base or better a cold-cream base (U.S.P.). It must be remembered, however, that in extensive corneal ulcerations, epithelization of the cornea is inhibited by penicillin or sulfa drugs, and the resulting scar is denser than usual. Local penicillin or sulfa medications in corneal conditions should be discontinued as soon as there is no sign of infection or purulent infiltration of the corneal wound.

Bacitracin

For gram-positive eye infections, bacitracin is an excellent therapeutic agent used as a five-percent ophthalmic ointment of Baciguent or Bacithracin. Irrigations or instillations may be done with Tyrothricin prepared according to the formula: Tyrothricin (0.15 to 0.45 cc. in two-percent alcohol solution); distilled water (15 to 30 cc.).

Streptomycin

The dosage of streptomycin or neohydrostreptomycin hydrochloride is 500,000 μg. or 0.5 gm. for systemic use daily for 10 to 20 days; for local administration streptomycin solution (10,000 to 20,000 μg. per cc.) in ointments in a base similar to that recommended for penicillin may be used. Present knowledge concerning the ophthalmic uses of streptomycin is, however, limited and inconclusive.

Aureomycin

For local use, 25 mg. of the substance should be dissolved in five cc. of distilled water containing 62.5 mg. sodium chloride and 25 mg. sodium borate. Two to three drops are used in the affected eye 8 to 10 times daily. For systemic use, tablets of 250 mg. are given every two hours for 3 to 4 days. A 0.1-percent ophthalmic ointment is also available.

Treatment for uveitis

In most cases of acute and subacute uveitis, the etiology, in spite of all systemic check-ups and investigations, is never satisfactorily clarified. Diseases of the uvea most frequently encountered are of the serous or nongranulomatous type. In the majority of cases, the uveitis seems to be due to direct infection from bacteriemias. Repeated transient bacteriemias, produced by the bacterial and metabolic products from distant foci of infection,[8] cause a sensitization and allergy of the uvea.

Patients with bacterial hypersensitivity may be treated with a vaccine prepared from the specific strain to which the individual is sensitive. This vaccine should be administered intravenously. The most striking results have been with a streptococcus vaccine.

Antihistamine drugs (especially Antistine) given intravenously can be used in uveitis which is believed to be caused by anaphylactic shock.

Bee-venom therapy (Apicur, Roche) may be very effective in rheumatic iridocyclitis or scleritis. Apply only intracutaneously and never intravenously.

In fever-shock therapy, experience has shown that large amounts of typhoid-paratyphoid vaccine are not necessary. The initial dose should be 10 to 15 million microorganisms dissolved in 1.0 cc. of saline solution in a tuberculin syringe. The next dose should be 10 to 20 million, with 80 to 100 million as the limit.

Some ophthalmologists prefer even smaller dosages of typhoid-paratyphoid vaccine. They start with 5.0 million microorganisms, later 7.5 million more, then 10 to 15 million, the limit being 30 million microorganisms per cc.

Vaccines for intramuscular injections cause less severe reactions (ambulatory fever therapy). Intravenous injections should be carried out only while patient stays in bed. Previous testing for typhoid-vaccine sensitivity is essential.

Temperatures of 101.8°C. to 103°C. are sufficient and no more than 3 to 4 episodes of fever are necessary. There should be at least 24- to 36-hour intervals between each injection.

Typhoid-A antigen is preferred for fever-shock therapy since it causes less systemic reaction. The dosage is the same as for typhoid-paratyphoid vaccine.

In some cases of subacute uveitis, staphylococcus toxoid (Lederle Dil. 2) may be tried. Doses start with 0.01, 0.02, 0.04, 0.08, 0.1, 0.2, 0.4, then 0.5 cc., once or twice weekly depending on the reaction. The injections are given intracutaneously from 0.01 to 0.2 cc., after which from 0.5 to 1.0 cc. is given subcutaneously.

When secondary glaucoma complicates uveitis and the usual measures are ineffective, cyclodiathermy may be attempted.

In cases of moderately increased tension, 12 applications, with the electrode, placed nine mm. from the limbus, 95°C., for 15 seconds, is recommended. When the tension is greatly increased, 20 applications (seven mm. behind the limbus, 100°C., for 15 seconds) can be used.[9]

Treatment of glaucoma

In acute, narrow-angle glaucoma and in acute inflammatory flare-ups of a quiescent, chronic, narrow-angle glaucoma, the first aim is to control the attack by means of miotics. First one-percent eserine salicylate is instilled and, 10 minutes later, five-percent prostigmin with 20-percent mecholyl; 15 minutes later, two-percent pilocarpine. Every hour thereafter alternate between furmethide (10-percent solution), pilocarpine, and eserine, in order to have each miotic effect its particular pharmacologic action. In addition, adrenalin may be combined with the miotics to counteract the hyperemia and congestion in the ciliary body.

As soon as the pupil becomes contracted, miotics should be used sparingly, even if the tension is still high, because only unnecessary irritation of the ciliary body will result.

Procaine hydrochloride (two-percent solution) injected retrobulbarly may counteract congestion and edema of the ciliary processes due to histamine reaction and may help drainage of the accumulated aqueous secretion. However, pilocarpine, carcholine, or furmethide will have to be instilled before the novocain injection, since a pupil contracted by eserine will become dilated by the pharmacodynamic action of the procaine.

In order to cause dehydration of the acutely congested eyeball, intravenous injections of 100 cc. of 50-percent sorbitol (a complex alcohol of the same molecular size as dextrose) will often be beneficial. This therapy should be cautiously administered in cases of diabetes.

If there is not a definite decrease in tension within the first 12 hours, surgery should be considered. A wide basal iridectomy is my choice of operation. If conservative medical therapy has been delayed for more than 48 to 72 hours, and the eye is still very congested, an iridosclerectomy is the operation

of choice because of already developed peripheral synechias.

Quite different is the treatment of chronic simple or wide-angle glaucoma. For local therapy, pilocarpine, carcholine, and furmethide are recommended, to be given in the smallest concentration possible.

Since the production of intraocular fluid is most active in the morning hours, instillation of drops is most important at this time. For proper timing of instillations, 24-hour tension curves are helpful. In order to avoid unpleasant ciliary spasm, especially in clerical workers, only 0.25- to 0.5-percent pilocarpine should be prescribed for wide-angle glaucoma of light and medium degree. The drops should be used at 6:30 to 7 a.m., repeated at 8 a.m. and possibly at 11 a.m.

Every 3 to 4 months, 1.5-percent carcholine or 10-percent furmethide should be substituted for the pilocarpine for 15 to 30 days. Pilocarpine will act more effectively after the period of substitution with these drugs. When eserine drops are used, cocaine should be added in order to reduce the incidence of local irritations and allergic reactions.

Di-isopropyl fluorophosphate (D.F.P.), a powerful miotic, is used in 0.05 to 0.10 concentrations. Although great caution has to be exercised in its use, this drug should be tried in cases in which the more conventional miotics have failed.

Surgical treatment in wide-angle glaucoma can best be governed by studying the pressure trend (Reese[10]). For chronic simple or wide-angle glaucoma, cyclodialysis may be the operation of choice. If peripheral synechias have developed, however, an iridosclerectomy should be considered. Iridosclerectomy is also recommended for Negroes since, in this race, heavy scarring may develop after cyclodialysis.

If, unfortunately, instillation of atropine has produced an acute glaucoma, 25 mg. of mecholyl in three cc. of two-percent novocain may be injected retrobulbarly. In most cases, this will prove an effective antidote.

Therapy of common eye afflictions

Eyelids

Hordeolosis, not controlled with routine therapy, may be helped by two injections of 10 cc. of blood taken from the cubital vein and injected intramuscularly, one week apart.

An alcoholic tincture of eucalyptus may be used in stubborn cases of blepharitis. Applications of cod-liver oil to the eyelids may also be beneficial.

Seborrheic eczema of the eyelids may be treated with five-percent sodium-propionate compresses and ointment. Injections of crude liver extract are a potent supportive treatment. In every case of seborrheic eczema the carbohydrate metabolism has to be regulated, and seborrhea of the scalp has to be corrected.

In cases of deficient conjunctival secretion, methyl cellulose (0.5-percent solution of the 400-centipoise type in physiologic saline) is an excellent substitute.

Diseases of the cornea

In cases of a large progressive corneal ulcer, hypopyon ulcer, indolent corneal ulcer, herpes corneae, or dentritic keratitis, systemic treatment should parallel local therapy. Insulin injections may help to improve the patient's nutrition, remove some factors necessary for the metabolism of the microorganisms, and increase the rate of the epithelial proliferation.

Ascorbic acid in intravenous doses of 500 mg. on 2 or 3 consecutive days, followed by 100 to 200 mg. given orally each day to produce systemic saturation, is also helpful in corneal conditions. In addition, intravenous injections of 5 to 10 mg. of riboflavin daily will be helpful, especially in ulcers associated with rosacea acne.

Herpes zoster ophthalmicus

In this condition, it is advisable to give 0.5 to 1.0 cc. of posterior or total pituitary extract. In addition, one may try 10-percent

sodium iodide or a French preparation, Naiodine, intravenously for 5 or 6 consecutive days. Large amounts of thiamine chloride and vitamin E will be useful. Smallpox vaccine or 250 cc. of convalescent serum from the blood of a patient who had recuperated from herpes zoster has given good results.

Recently, it has been found that early systemic administration of 250 mg. tablets of aureomycin every two hours for 3 or 4 days may shorten the duration of this severe eye affliction. Aureomycin seems to act favorably in preventing deep scarring and annoying after pain and toxic edema of the eyeball and eyelids is rapidly reduced. For the acute stage, Domeboro tablets provide a convenient Burow's solution for topical use. Calomel powder may be used in the vesicular stage. For the herpetic pain, either one cc. of 40-percent alcohol may be injected retrobulbarly or X-ray therapy may be directed to the gasserian ganglion.

In cases of punctate superficial keratitis or in small epithelial defects from herpes corneae or dendritic keratitis, aureomycin drops may be tried in the early stages. If this is not helpful, instillations of a 0.05- to 0.1-percent solution of methylene blue in saline every three hours for 4 or 5 days is advised. However, this treatment is not good for large epithelial defects.

For such large epithelial defects, the following procedure has been helpful: With a dental drill, remove the various areas of ulceration and wipe off the devitalized tissue with blotting paper. Touch the denuded area with either phenol or a mixture of seven-percent iodine and five-percent potassium iodide; or apply a 15-percent zinc-sulfate solution and immediately remove the excess solution with saline. Finally, aureomycin drops or a 30-percent sulfacetimide solution in an eyecup may be useful, especially in dendritic and other forms of keratitis.

In cases of keratoconjunctivitis sicca, local instillations of progynon in sesame oil have proved effective in conjunction with treatment of the endocrine derangement which usually accompanies this condition.

In rosacea keratitis there is usually an associated staphylococcic infection which responds well to staphylococcus-toxoid vaccinations and to sulfa drugs used locally.

For corneal epithelial dystrophies, oral medications with amino acids are advised, since such conditions may be the manifestation of an amino-acid deficiency. Similarly, lack of luster of the cornea may be treated with amino-acids. If a corneal epithelial dystrophy does not respond to the treatment, multiple punctures with a fine cautery and touching with iodine should be tried, followed by eyepads and mydriatics. The use of contact lenses is recommended for such epithelial disturbances of the cornea.

Local instillations of choline chloride in 1- to 10-percent concentrations are advised in the following corneal conditions: (1) To clear corneal scarring of recent date by dissolving fibrin and fat; (2) to remove a thin pterygium; (3) in punctate keratitis; for the removal of Bitot's spots and pinguecula; (5) in poorly healing corneal ulcers (use crystals directly).

Annoying burning sensations in the eyes in which there is no evidence of a pathologic condition have been found to be due to vitamin-C deficiency.

Burns of the eyes

The best thing to do is to apply copious irrigations to the conjunctival sac, irrespective of whether it is an acid or alkali burn. Afterward, use a 1:20 caster-oil saturated solution of hydrosulphosol (Ree, Davis, Co.).

In ammonia and gasoline burns, a paracentesis of the cornea for 5 to 7 consecutive days may prevent a dangerous secondary glaucoma and dense corneal opacifications.

In burns due to mustard gas or Lewisite, two-percent sodium-bicarbonate drops, 10-percent glucose, or paraffin-oil drops have been recommended. However, the best treatment for such burns is BAL (five percent) ophthalmic ointment.

Tannic acid should not be used for burns around the eyes, since it may lead to undue scarring.

Allergies of the eyes

These conditions include not only allergic manifestations of the eyelids, palpebral and bulbar conjunctivas, but chalazions, retinal hemorrhages from insulin, scintillating scotomas, retrobulbar neuritis, or even glaucoma. Among the more important exciting factors in allergies of the eyes and eyelids are the various drugs used locally, cosmetics (especially nail polish), furs, dyes, and spectacle frames.

Antihistaminics internally or intravenously are advised. The least toxic of the many antihistaminics seem to be thephorine (Roche) and antistine (Ciba). Local applications of salves and solutions of antihistaminics are recommended. Instillations of 0.25-percent neosynephrin or 1:2,000 adrenalin are very effective. Histaminase (20 units, three times daily) is recommended in cases of food sensitivity. Vitamin D and calcium, together with a salt-free diet, form part of this therapy.

For annoying itch of the eyes, a one-percent solution of acetic acid, followed by ice packs, is advised; or a one-percent solution of monohydrated sodium carbonate in five-percent alcohol may be prescribed to dissolve the irritating mucous substances. To relieve excessive itch of the skin of the eyelids, five-percent silver nitrate may be used if it is subsequently neutralized with saline solution. Cold compresses are applied to the eyelids, and the patient should avoid soap and creams. Domeboro tablets dissolved in water can be used for weeping allergic dermatitis. Among the ointments which can be recommended are hydrosol (Hydrosol Laboratories), cold cream (U.S.P.), or two-percent zinc-oxide ointment (U.S.P.).

Eye injuries

Oxygen therapy is one of the newer methods of treating various eye injuries. In traumatic keratitis, traumatic cataract, traumatic vitreous hemorrhages, or deep scleritis, oxygen is insufflated under the conjunctiva until there is marked elevation. Treatment consists of 5 to 15 insufflations and is given 2 to 7 times. The intention is to counteract the harmful effects of acute tissue anoxia.

Retinal vascular disorders

In diabetic or central serous retinopathies, in Eales's disease, thrombosis of the retinal veins, thrombophlebitis, and thrombo-angiitis obliterans, administration of heparin-dicumarol is recommended, if all clinical precautions are taken.

In addition, such patients should be given ascorbic acid (100 mg., three times daily) followed by rutin or hesperidin (at least 50 mg. three times daily) for 1 or 2 months. In certain cases of retinal vascular disorders, daily doses of 200 to 300 mg. of tocopherol (vitamin E)have proved successful.

Intravenous injections of novocain in retinal thromboses and retinal edema is a new form of therapy upon which final judgment has not been passed. The dosage is four mg. of novocain per pound bodyweight in a one-percent solution of ascorbic acid. Procaine acts as an anticholesterase in such cases.

Vasodilator therapy

This therapy has been found useful in certain cases of acute ocular vascular catastrophies, such as occlusion of the central retinal artery, acute retinal edema, and so forth.

In these cases, spasmolytics, such as papaverine-hydrochloride (0.5 to 2.0 gr.) injected slowly intravenously, together with acetylcholine injected retrobulbarly, are very effective. In subacute spasmodic conditions, aminophylline and papaverine (0.25 to 0.333 gr., daily), together with barbiturates and theominal, are effective.

Paracentesis

Puncture of the anterior chamber to be done early, is being recommended more fre-

quently not only for such conditions as occlusion of the central retinal artery and chronic, quiet iridocyclitis, but also in optic-nerve atrophies, retrobulbar and intrabulbar neuritis, and so forth. In these last-mentioned conditions, the beneficial results of paracentesis are hypotony and increased vascularity of the posterior portion of the eyeball.

In optic neuritis from tryparosan treatment, BAL (300 mg., internally, twice daily, and then once during the next seven days) is helpful.

Ocular syphilis

In cases of ocular syphilis, treatment with an aqueous solution of bismuth and pentavalent arsenical (tryparsamide, carbarsone) is contraindicated. However, if treatment is introduced with an oily suspension of bismuth and continued with a trivalent arsenical (neosalvarsan, sulfarsenal, mapharsen, bismarsen) the results are more likely to be satisfactory.

Fever therapy introduces the treatment of syphilitic interstitial keratitis, to be followed by bismuth and then a trivalent arsenical. Potassium iodide is usually contraindicated.

Radiation therapy[11]

Beta radiation is indicated in vernal conjunctivitis, acne rosacea, nonmalignant lesions of the eyelids and bulbar conjunctiva, and tuberculosis of the anterior segment. The maximum reaction occurs in 14 to 21 days, so that a four-week interval is allowed between each treatment.

Gamma-ray or X-ray irradiations are used in treatment of angiomatosis of the retina, diabetic hemorrhages, and hyperplasia of the anterior uvea. X-ray treatments may be tried in hemorrhagic glaucoma to relieve pain, stop the hemorrhage, aid absorption, and prevent further thrombosis in the retinal veins.

Summary

Various therapeutic measures suggested during the last 4 or 5 years for the treatment of eye diseases have been presented. An attempt has been made to discuss the care of eye diseases which occur most frequently in the ophthalmologist's everyday practice.

5 West 86th Street (24).

References

1. Mann, I.: Brit. J. Ophth., **30**:134-146, 1946.
   Vorisek, E. A.: Am. J. Ophth., **30**:29-40, 1947.
   von Sallmann, L.: Arch. Ophth., **34**:195-201, 1945.
   Sorsby, A.: Modern Trends in Ophthalmology. New York, Hoeber, 1947, v. 2, pp. 394-410.
2. Benedict, W. L., and Henderson, J. W.: Am. J. Ophth., **30**:984-986, 1947.
   Hughes: Brit. J. Ophth., **43**:43-46, 1948.
   Sorsby, A.: Modern Trends in Ophthalmology, v. 2, pp. 383-392.
3. Bellows, J., and Farmer, C.: J.A.M.A., **135**:491-495, 1947.
   Maschler: Brit. J. Ophth., **32**:426-428, 1948.
4. Bellows, J., and Farmer, C.: Am. J. Ophth., **31**:1070-1073, 1948.
   ———: Am. J. Ophth., **31**:1211-1216, 1948.
5. Braley, A., and Sanders, M.: Ann. New York Acad. Sc., **51**:280-284, 1948.
6. Yasuna, E. R.: Arch. Ophth., **37**:598-607, 1947.
7. Selinger, E.: Arch. Ophth., **38**:645-653, 1947.
8. Woods, A. C.: Tr. Am. Acad. Ophth., **51**:75-92, 1946.
9. Weekers, R. Bull. Soc. franc. d'ophth., **60**:245-252, 1947.
10. Reese, A. B.: Am. J. Ophth., **31**:25, 1948.
11. Ruedemann, A. D.: Arch. Ophth., **41**:1, 1949.
    Iliff, C.: Tr. Am. Acad. Ophth., Sept.-Oct., 1946, pp. 36-45.
    ———: Bull. Johns Hopkins Hosp., **80**:298, 1947.
    Guyton, J. S., and Reese, A. B.: Tr. Am. Acad. Ophth., May-June, 1947, pp. 525-546.

THE RELATIONSHIP OF HETEROPHORIA TO DEPTH PERCEPTION IN AVIATION*

With particular reference to the work of the Royal Canadian Air Force

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Part III

VI. Royal Canadian Air Force investigations on the relationship of heterophoria, fusion, and acuity of stereopsis to flying performance

A number of investigations were carried out by the Royal Canadian Air Force to study the relationship of flying performance to ocular muscle balance in all its aspects, such as heterophoria, fusion, and acuity of stereopsis. These studies for the most part involved the recording of the ocular characteristics of a group of pilot candidates, and then following their progress through the system.

It might be as well, then, to review quickly the path along which a pilot candidate passed to his graduation with "wings." A young man applying for aircrew duty made his first appearance at a recruiting center. There he was interviewed. His scholastic background was investigated, and he was given a psychologic aptitude test and a medical examination.

His ocular status was investigated, with the following points being noted; visual acuity, manifest hypermetropia, color vision, and the presence or absence of ocular disease of any sort. During the first four years of the war, tests for ocular muscle balance were carried out at recruiting centers. Later, this practice was dropped as it was felt that recruiting centers need test only for acceptance to aircrew in general, faulty ocular muscle balance being a bar only to pilot duty and not to other aircrew positions.

Following these examinations, if the candidate was accepted for aircrew duty, he then proceeded to Manning Depot for basic training and equipping. He then went to an initial training school. There his basic training continued, and he began his ground-school study of mathematics, aerodynamics, navigation, signals, and such like. He also was given a detailed medical examination by a board of medical specialists, referred to as the Medical Selection Board. One of these specialists was an oculist. The candidate was given also a four-period course on the Link trainer, which was used mainly as a selector and not as a trainer at this point.

At the end of his course of training at the school, his performance record and medical record were reviewed by a board referred to as the Aircrew Selection Board. By this board he was selected for duty and training in a certain position in aircrew.

If he were selected for pilot, he then proceeded to Elementary Flying Training School. Here his ground-school subjects were continued, and he started on his actual flying career, using light aircraft. He might be "ceased training" at this level for a number of reasons, such as failure in ground-school subjects, poor health, or poor flying performance.

After about 50 hours flying, if he passed all these hurdles, he then went to Service Flying Training School. There he continued his ground-school subjects, but now he flew higher performance, single-engine aircraft or twin-engine aircraft, depending upon which service school he had been sent to. He might be "ceased training" here for the same reasons as at Elementary Flying Training School.

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After a total of about 150 hours' flying, the successful ones were graduated and were presented with their "wings." Aircrew then proceeded to Operational Training Units. Early in the war, all these latter were in England. Later, a few were set up in Canada. There the candidates were "crewed up" for operations; that is, each aircraft team was brought together, and full-operational types of aircraft were flown.

The various investigations set up in the Royal Canadian Air Force to study the relationship of ocular muscle balance to flying performance were centered about the Medical Selection Boards. The various investigators there made arrangements with the Elementary and Service Flying Training Schools to which their pilot candidates had proceeded to report back to them concerning what had transpired.

One of the earliest studies on the relationship of heterophoria to flying performance was carried out by Elliot in 1942.[40] This study has been referred to in Sections I and V. He studied the frequency and amount of heterophoria in 175 "ceased-training" pilots, and in 50 experienced successful pilots. The 175 "ceased-training" pilots were selected carefully to insure that their failure was due to landing difficulties and not to some other trouble, such as air-sickness, for example. He could find no relationship between landing ability and the degree or type of heterophoria.

Clements, Livingston, and others frequently have stated that pilots with exophoria tend to level-off too high when landing, while pilots with esophoria tend to fly into the ground. Elliot could find no substantiation for this statement. If the "ceased-training" pilots were divided into three groups—those who landed too high, those who landed too low, and the erratic landers, it was found that the distribution of esophorics, exophorics, and orthophorics in each landing type was not significantly different. Also, this distribution was the same as was found in the control group of 50 successful pilots.

In 1942, Adamson,[222] working at No. 2 Initial Training School, investigated the Howard-Dolman Test for depth perception. Considered purely as an instrument he felt it gave very unreliable results. Also, he could find no relationship between flying performance and the depth-perception rating with this instrument.

In July, 1943, Kane[223] published another study involving 3,878 pilot candidates posted from No. 2 Initial Training School. He followed these through Elementary Flying Training School, where 743 "ceased training" for flying reasons, and through Service Flying Training School, where another 301 "ceased training" for flying reasons.

An apparent relationship of flying failure to poor convergence was found at the former school, but not at the latter. However, the numbers were too small to permit sound conclusions. He found no relationship between flying failure and the Maddox-rod and cover tests. This study had only internal controls.

The very carefully worked-out study of Kirschberg,[219,220] reported in 1944, relating heterophoria to fusion and to acuity of stereopsis as measured with a modification of an instrument designed by Verhoeff, has been mentioned already in Parts I and II. He also could find no relationship between the degree or type of heterophoria and flying performance. He could find no relationship between fusion, as measured with the Bishop Harman diaphragm or the Worth amblyoscope, and flying performance. Nor could he find any relationship between the acuity of stereopsis and flying performance.

Further, he followed 35 pilot candidates who were permitted to proceed with pilot training in spite of having ocular muscle balance definitely outside the permissible limits. Only 11.4 percent failed to graduate with wings. In the control group, 26.4 percent failed. His study was so carefully conceived in all its aspects that one feels compelled to accept his findings.

His findings confirm those reported by Barr[224] concerning a study carried out at

No. 5 Initial Training School in 1942, using much more unreliable instruments for measuring stereopsis. The latter reported on an assessment of the depth perception of 133 student pilots with Livingston's rotating depth-perception apparatus. These assessments were correlated then with flying performance. The correlation coefficient was found to be −0.03 with a probable error of ±0.06. Obviously, there was no significant relationship between the two.

Kirschberg's findings further confirm those reported by Elliot in 1942[41] in connection with a study of the frequency and significance of aniseikonia. An experienced pilot with normal vision was fitted with a variety of aniseikonic lenses. With a co-pilot to assist in case of trouble, he was requested to land his aircraft. It was found that he had no trouble in landing on a prepared airport. Some difficulty in landing, though not of a disastrous nature, was apparent on attempting to land on unprepared landing strips. Apparently, when binocular clues predominate some difficulty under such conditions is to be expected, but under the usual conditions there is no difficulty.

Finally, mention should be made of the very detailed study carried out at No. 5 Initial Training School mentioned in the previous section.[225] In this investigation, 2,453 aircrew trainees were examined, and the detailed ocular findings were coded on Hollerith cards. Their progress was followed through Initial, Elementary, and Service Flying Training Schools. No practical conclusions could be drawn as to the relationship of ocular muscle balance to success at Initial Training School.[225] This school, as already mentioned, was concerned mainly with groundschool studies. Also, the Medical Selection Boards were effective at this level. Thus, those with ocular muscle balance outside the limits for pilot duty might be placed in other aircrew trades for reasons other than natural aptitude.

Of the original 2,453 aircrew trainees examined, 1,448 were passed out of Initial Training School as prospective pilots, and these proceeded to actual flying training.[226] In general, it was found that flying success had no relationship to the degree of heterophoria, the desire for fusion as measured with the Bishop Harman diaphragm test, or near-point convergence.[226]

TABLE 13

CANDIDATES WITH CONVERGENCE INSUFFICIENCY

Relative Maddox-Rod Findings	No. Cases	No. Grads.	Percent Grads
1. Same at distance and near	109	83	76.2
2. Convergence insufficiency less than 10 prism diopters	1,076	751	69.9
3. Convergence insufficiency of 10 or more prism diopters	71	46	64.8
4. Convergence excess	179	107	59.8

There were two rather isolated and interesting correlations with flying performance, though. There was a correlation between the relative Maddox-rod readings at near and far, and flying performance. Usually at near the Maddox rod gives a relatively more exophoric reading than at far.

It was found that there was a definite tendency for pilot trainees with convergence insufficiency of 10 prism diopters, or more, or with a relatively high convergence excess, to graduate less often than others, as indicated in Table 13. These figures confirm those of Anderson,[171] mentioned in Section III. He found a correlation between flying success and "controlled convergence."

This relationship was significant at the two-percent chance level. The difference between the graduation rates of the "convergence-excess" group and the remainder was significant at the one-percent chance level.

It was found, secondly, that candidates with a hyperphoria at 15 inches of one prism

diopter or more (table 14) were considerably less likely to graduate than those with hyperphoria of less than one prism diopter. This difference was significant at the one-percent level.

It is interesting to note that hyperphoria at distance was not very significantly related to flying performance. In those with hyperphoria at distance greater than one prism diopter, the graduation rate was 52.5 percent, as compared with 68.9 percent graduating among those with hyperphoria less than one prism diopter. This difference was significant only at the 60-percent level.

It will be remembered from the study by Minnes and Shagass[212] on the interrelationships of the ocular muscle balance tests, mentioned in the previous section, that hyperphoria tends to be associated with poor fusion. It was recorded in Section IV that Wilmer[178] felt that anoxia had a more severe effect on those with exophoria and hyperphoria than on those with esophoria.

It will be noticed in the present study, both in the instance of the relative Maddox-rod readings and hyperphoria for near, that though significantly more graduated when convergence was normal, or when hyperphoria was of small degree, yet many with poor readings in these respects successfully completed their flying training. It will be remembered that Minnes, Crawford, and Shagass[211] showed that the Maddox-rod test at near was relatively unreliable. The correlation of relative Maddox-rod findings with flying performance in this one study must be assessed with this in mind.

To summarize these findings, it is fair to state that flying performance showed no relation to fusion and acuity of stereopsis. By and large, heterophoria apparently did not affect flying performance, though in a minority of those with convergence insufficiency and hyperphoria greater than one prism diopter at near, these faults had an adverse effect.

It should be stated here that, although so little was found in the relationship of ocular muscle balance to flying performance, several studies showed a definite relationship between visual acuity and flying performance.[220, 223, 226, 227] The figures of the DMS/Air[226] study are particularly significant. In 1,448 pilot trainees, by grouping the visual acuities according to the worse eye, the data in Table 15 were obtained.

TABLE 14

CANDIDATES WITH HYPERPHORIA

Hyperphoria (15 ins.)	No. Cases	No. Grads.	Percent Grads.
1. Less than 1 prism diopter	1,400	972	69.5
2. 1 prism diopter or more	35	15	42.8

Thus it would appear that poor visual acuity has a definitely deleterious effect upon the ability to learn to fly. This finding was significant at the three-percent chance level.

In a later and very carefully worked out study, McCulloch and Crush[228] found a definite relationship between acuity of stereopsis and visual acuity. It is to be remembered that variations in visual acuity will affect not only the perception of binocular clues, but also of monocular clues to depth. It is not surprising that poor visual acuity has an ill effect.

VII. Orthoptics in aviation

In Section III several studies were mentioned which dealt with orthoptics in aviation. It will be remembered that Clements[115] reported on the first work in 1919. Supporting his opinion of its great value were the studies of Flack,[117] Berens,[128] Livingston,[138] Schwichtenberg,[229] and Anderson.[172] Papers by Brailey[25] and Tostevin,[174] and studies by Willoughby[173] and Travers[175] took the opposite viewpoint, however.

Early in 1942 the Royal Canadian Air Force set up plans to study the problem.

Naturally, the focal point of the matter was the group of studies mentioned in the previous sections which dealt with heterophoria, fusion, stereopsis, and flying performance. If there should be little relationship here, then orthoptics would have a very limited value. The answer to this problem was left to the other studies, already mentioned, to settle.

It was felt that the most productive field for study would be, first, in the rehabilitation of pilots suffering from asthenopia, or having landing difficulties, and in whom ocular muscle balance was found to be outside the limits set down by the visual standards; and, second, in attempting to raise to flying category, a group of aircrew candidates who were outside the ocular muscle balance standards for pilot duty. It was planned to follow members of this second group through the training system, and to attempt to determine their ability to learn to fly and the stability of the results.

The results of these studies have been reported by Nicholls,[230] Nicholls and Mines,[231] and Nicholls.[232] The results by and large were inconclusive. The studies were plagued from the start with administrative difficulties relative to the movement of personnel. Also, the number actually studied was too small to be of conclusive value. However, these results are reported here as they gain interest and value when considered in relation to the other Royal Canadian Air Force studies.

In June, 1942, an orthoptic unit with five orthoptists was set up at No. 1 Manning Depot, Toronto. For about 10 months all orthoptic cases were routed through this unit. It was intended to have those who had undergone orthoptic training routed back at later dates for follow-up study. For administrative reasons, the unit was broken up late in 1943. The orthoptists were detailed to work separately under various oculists across the continent of Canada. Hence, these follow-up studies became impossible to carry out.

In regard to the first study dealing with the rehabilitation of pilots suffering from asthenopia and landing difficulties, a serious problem immediately arose—the selection of proper cases. For instance, just because a pilot is having asthenopia, which may or may not be associated with landing difficulties, and it is found that he has some ocular muscle imbalance, it is not necessarily right to conclude that there is a relationship between the two.

TABLE 15

RELATIONSHIP OF VISUAL ACUITY TO FLYING PERFORMANCE

Visual Acuity (worse eye)	No. Cases	No. Grads.	Percent Grads.
20/20	1,317	915	69.5
20/30	79	53	67.1
20/40	34	21	61.8
Less than 20/40	18	8	44.5

Malingering may play a part, for example. The orthoptic unit was in Toronto—thus, it was an attractive matter to assume symptoms so as to spend a sojourn in the city. Undoubtedly psychogenic ills may play a part, as well as malingering, in the occurrence of cases for treatment. As well as possible, these factors were kept in mind in the selection of material for training. Although it is felt that malingerers were pretty well excluded, it is by no means certain that psychogenic factors did not play a large part in the occurrence of the symptoms of the others. Two thirds of those treated were suffering from flying fatigue, mild conversion hysteria, or depressive states. This upholds very well the much more factual data of Beccle and Kitching[233] published in 1945. These limitations must be kept in mind in any discussion of the data.

In all, 20 such patients were given treat-

ment, but only 15 completed it. Of the latter 15, one was suffering from pure asthenopia, four were having landing difficulties pure and simple, and the remaining 10 had a combination of landing difficulties and asthenopia. Of the total number of subjects treated: (a) 10 (50 percent) had convergence insufficiency; (b) seven (35 percent) had divergence excess and convergence insufficiency; (c) three (15 percent) had esophoria and convergence insufficiency.

As a rule, the amplitude of fusion was seriously affected. However, stereopsis, as measured with Livingston's rotating stereograms under consultation room conditions, was affected in only one half of the cases.

Of the 15 who completed treatment, 13 were discharged from the clinic with a full pilot category. They were well within pilot standards. One was given a limited pilot category, for, though his ocular muscle balance, using standard Royal Canadian Air Force instruments, placed him in pilot category, his amplitude of fusion was limited. Thus, it was felt that the result was unstable. The final patient was given a limited flying category because of defective visual acuity due to compound myopic astigmatism. It was not possible to follow these patients with any success.

The second part of the study relating orthoptics to aviation was much more satisfactory. In this study, an attempt was made to take a group of aircrew candidates, who were outside pilot category because of ocular muscle imbalance, and place them in pilot category by orthoptic training. Again the numbers were small, hence only limited conclusions can be drawn.

Between July 1, 1942, and December 31, 1942, all aircrew candidates appearing at No. 11 Recruiting Center, Toronto, were examined for suitability for aircrew training, giving particular care to the ocular-muscle status. During this period, some 4,327 aircrew candidates were examined and found fit for training in the Royal Canadian Air Force at this recruiting center. Of this number, 193 were found to have ocular muscle balance outside standards for pilot training.

These 193 candidates were then referred to the orthoptic unit established at that time at No. 1 Manning Depot, Toronto. There they were given a careful diagnostic run on the orthoptic instruments and other standard muscle investigation equipment by an ophthalmologist and the orthoptists. Since old standing paretic lesions, marked hyperphoria, marked divergence excess, do not respond to present orthoptic techniques, such cases were excluded.

As a result of this exclusion, 77 patients were accepted for orthoptic training. Of this number: (a) 39 (50.7 percent) had convergence insufficiency; (b) 27 (35.0 percent) had divergence excess with convergence insufficiency; (c) 11 (14.3 percent) had esophoria with convergence insufficiency.

It will be noted that the distribution of these cases is remarkably similar to the distribution of pilots accepted for rehabilitation treatment mentioned above.

Within certain limits, orthoptic training was continued until such time as the ocular muscle balance came within pilot requirements, and appeared stable in the opinion of the orthoptist and the ophthalmologist. In order to be considered stable, the amplitude of fusion had to be at least 50 prism diopters. Also stereopsis had to be stable. Arbitrarily, a limit of 6 to 8 weeks was placed upon the maximum period allowed for orthoptic training.

Under these conditions, 63 patients were trained successfully, and brought within the standards for pilot duty, and then were posted to Initial Training School for training and selection for aircrew in the ordinary way. The mass of these cases went to No. 5 Initial Training School. However, a few went through No. 1 and No. 3 Initial Training Schools. Upon entry to Initial Training School, these candidates were treated in the same manner as all other candidates for aircrew.

As stated above, in the six months from

July 1, 1942, to December 31, 1942, 193 (4.5 percent) of the 4,327 aircrew candidates passing through No. 11 Recruiting Center were found to have ocular muscle balance outside the standards for pilot training. As already mentioned, of the 193 referred for orthoptic training, 63 (or 33 percent) were successfully trained and passed into the aircrew training system. Of the 63 sent to Initial Training School, 34 (or 54 percent) graduated from Initial Training School as potential pilots, and were posted to Elementary Flying Training School for actual flying training.

A control group consisting of those who had an ocular muscle balance always within normal, and who were trained at Initial Training School, Elementary Flying Training School, and Service Flying Training School at the same time, may be used for comparison. Among these controls, 55 percent graduated from Initial Training School as potential pilots. Both groups passed through the usual selection procedures as outlined in the previous chapter.

Of this group of 34 potential pilots from the orthoptic study: (a) 18 (53 percent) were graduated as pilots; (b) 14 (41 percent) ceased training for flying reasons; (c) one ceased training for air-sickness; (d) one ceased training for medical reasons.

Among the controls it was found that 33 percent ceased training for flying reasons and 65 percent graduated as pilots. The difference between the success of the control and the study groups is not statistically significant.

Thus, of a group of 193 candidates found unfit for pilot duty, only 18 were added to the number graduating as pilots by means of orthoptic training. Assuming, therefore, that good ocular muscle balance is essential to safe flying, this represents a net salvage rate of 9.3 percent at prevailing selection and wastage rates. To put it another way, of an original 4,327 aircrew candidates, 1,547 graduated as pilots. By orthoptic training, 18 (1.1 percent) were added to this total.

To further study the stability of the orthoptic results obtained, 15 subjects chosen at random from the group given orthoptic training were placed in a decompression chamber and exposed to a simulated altitude of 17,000 feet for five minutes. Eleven had had convergence insufficiency, two had had divergence excess with convergence insufficiency, and two had had esophoria and convergence insufficiency. The time at which this was carried out was approximately four months following completion of orthoptic training.

The following tests were carried out before exposure and after exposure for five minutes, Accommodation was measured with the binocular gauge. A manifest refraction was carried out to determine if the development of poor accommodation was related to the magnitude of refractive error present. The ocular muscle balance was measured subjectively with the Maddox rod and objectively with the screen and prism test to ascertain if the result of orthoptic training was due to an actual alteration in the anatomic position of the eyes, or simply to a subjective improvement brought about by a greatly augmented amplitude of fusion. The amplitude of fusion was measured with the Hughes rotating prism and the effect of anoxia on the fusion range was noted.

In only one of the 15 subjects (one with esophoria and convergence insufficiency) was there any real indication of deterioration of the ocular muscle balance four months after cessation of orthoptic training. In none of the 15 subjects was there any instability of the ocular muscle balance when tested under anoxic conditions. None of the subjects showed any appreciable deterioration of accommodation or of amplitude of fusion under the anoxic conditions.

A discrepancy was found between the amount of angular deviation as measured by the Maddox rod and that measured by the screen and prism test. The esophoric findings were usually smaller, and the exophoric findings were usually larger when measured with

the screen and prism test. Thus, it would seem that the Maddox rod does not dissociate as completely as does the screen and prism test. This finding has been amplified further by Scobee and Green.[207] The figures, though not conclusive, tend to indicate that the improvement from orthoptic training comes from an increased amplitude of fusion.

As has been pointed out, 18 of those given orthoptic training graduated as pilots. An attempt was made to follow these over a period of time. The attempt was not entirely successful. Of the 18, four eventually saw overseas duty, one saw active duty in Newfoundland, and 13 were retained on home duty. Annual medical examinations were recorded on all but five cases. In two cases, the last annual medical examination recorded is that only one year after orthoptic training. In four cases, two years, and in seven cases, three years had elapsed. In all cases good ocular muscle balance had been maintained up to the time of the last recorded examination.

From the results of the rehabilitation study of experienced aircrew, this much can be said; there is great difficulty in assessing the true relationship of ocular muscle balance to asthenopia. Symptoms of eyestrain, such as headache, burning, and tearing of the eyes, are commonly credited by ophthalmologists with possibly arising from ocular muscle imbalance. However, the same symptoms may appear as a result of psychiatric disturbances. Thus, in many cases, it is difficult to decide the exact origin of the symptoms. Particularly is the decision difficult in those cases where the psychiatric disturbances and ocular muscle imbalance are co-existent. Much the same trouble seems to occur in the problem of the pilot having landing difficulties.

The figures dealing with the second study speak for themselves. The pilot salvage rate of 1.1 percent cannot be considered an economically sound project. The amount of time, effort, and expensive apparatus that went into the training of the original group of 63 pilot candidates was out of all proportion to the possible small success of the project. However, the study indicates that, in selected cases, orthoptic treatment will produce stable ocular muscle balance for at least one year, and in many cases for three years. Therefore, in experienced pilots who represent a great investment, and who are suffering from eyestrain, orthoptic training may be of value.

VIII. Discussion of the relationship of depth perception to aviation

To this point a great mass of data has been reported and commented upon. The matter may be summarized by stating that little sound evidence has been found to prove that heterophoria and stereopsis have any close relationship to flying performance, with special reference to landing ability. There is sound evidence that anoxia and advanced fatigue may affect the ocular muscle balance in some people. However, it is interesting to note that stereopsis—the pinnacle of the ocular-muscle-balance pyramid—is very resistant to the effects of anoxia, and possibly to fatigue too. Modern oxygen equipment and aviation usage have rendered this problem largely academic.

Even the several studies of the Royal Canadian Air Force, most of which had careful controls, have not been able to support the view that ocular muscle balance and stereopsis are important. In only one study was any correlation found. In this study it was found that the presence of relatively high hyperphoria at near only, which might or might not be associated with poor convergence, reduced the graduation rate of pilot trainees.

In the same study it was found that convergence insufficiency reduced the graduation rate of student pilots, though the near point of convergence had no predictive value. These effects were not marked, but were significant statistically.

These findings were confirmed by a study recently reported by Imus.[234] In his inves-

tigation, Imus attacked the problem from another aspect. Two hundred and fifty successful pilots were given a detailed eye examination. It was felt that data of importance would be collected if one were to assume that visual factors of great importance in aviation would cluster about some level, while those not critically important would show a wide distribution of values. Such an assumption would seem justified as the results obtained agree very closely with those of the Royal Canadian Air Force.

It was found that the subjects presented superior scores in visual acuity, near vision, and far and near vertical heterophorias. Wide distribution of scores were found in horizontal heterophoria, near point of convergence, and stereopsis.

In Australia, Anderson's[172] data indicate that orthoptic training carried out before a pilot undertakes flight training reduces the number of hours necessary to "go solo." These data were not confirmed in all their aspects by other Australian workers. Thus, at most, one can find support for only a very faint relationship between ocular muscle balance and flying ability.

In what measure, then, can one form an hypothesis to relate ocular muscle balance to flying performance? What formula will encompass all the known facts? The problem of depth perception as emphasized by Elliot[40] has two aspects, an objective one and a subjective one.

From the objective point of view, Elliot pointed out that there are few situations in aviation where binocular clues to depth are dominant. This topic was more fully reviewed in Section I. It is my opinion that this is a true statement of affairs. If this be granted, then the whole problem becomes greatly reduced in importance and scope.

The more subjective aspects of the problem have been emphasized elsewhere.[235] Since the monocular clues to depth depend for their interpretation upon experience, it would not be surprising if, in the early hours of flying training, pilot trainees were heavily dependent upon the more physiologic binocular clues to depth. This speculative conclusion may account for Anderson's data showing that "the time to go solo" is reduced by previous orthoptic exercises.

Certainly, this dependence on binocular vision, if present, has disappeared pretty well by the time the trainee has completed about 50 hours of flying. In the Royal Canadian Air Force this point came at the conclusion of the course at the Elementary Flying Training School. At this point the acuity of stereopsis bore no relationship to the graduation rate at these schools. There can be little doubt that this dependence has disappeared after 150 hours of flying—the point of graduation from Service Flying Training School.

In reviewing the literature on this rather controversial subject, I was struck by the few references to the more psychologic aspects. It is felt that this is a grave oversight. The concept should be emphasized here that the eyes are merely end-organs; that is, they receive information which then must be transmitted to the brain for interpretation. In respect to depth perception, therefore, the eyes are biologic altimeters and speed indicators. The information so obtained must be interpreted accurately by the brain if safe landings are to be carried out. It is possible for one to have exceptional eyes and yet, owing to psychologic difficulties, to be unable to make effective use of the information obtained. Fear, air-sickness, low intelligence, and the like may affect the interpretation of the information obtained from the eyes, and thus lead to poor landings.

It becomes an interesting and useful speculation, then, to attempt to formulate an hypothesis which will place the various parts of the problem in their proper relationship. The following formula, it is felt, covers the known facts. Since the findings recorded in this thesis indicate that binocular vision has little relationship to flying performance, it may be felt that ocular muscle balance has been given undue prominence in the formula.

However, since this relationship is the focal point of this study and has been the center of much controversy it is felt that this prominence is justified.

In respect to depth perception, pilots fall into four fairly distinct groups:

(a) *Group I.* Those with good ocular muscle balance and who are good leaders.

This group has good coördination between the two eyes—what has come to be referred to as good ocular muscle balance. Thus, good binocular depth perception is possible. Landings are good. This is the ideal sought by the present visual standards. These standards, as pointed out previously, are based upon the traditional point of view that good binocular vision is essential to safe landings, for which there is little or no scientific verification.

(b) *Group II.* Those with good ocular muscle balance, but who are poor landers.

In this group the individual has good ocular coördination, that is, good ocular muscle balance. Therefore, it can be assumed that he has some degree at least of binocular depth perception. Experience shows that the majority of these cases have fair to good binocular depth perception. And yet their landings are poor.

Obviously, therefore, in this group the difficulty does not lie in the ocular mechanism per se. The difficulty can only lie in the interpretation of the brain of the information obtained from the eyes, or in the effector mechanism of the body. Judgments are affected in this group by such things as fear, tenseness, low intelligence level, air-sickness, and a number of other such factors. Also, poor skeletal muscle coördination may play a part.

In the Royal Canadian Air Force, selection by the visual link was intended to do away with this latter group, but was not wholly successful.

(c) *Group III.* Those with poor ocular muscle balance, but who are good landers.

In this group are those with poor binocular vision possibly owing to poor coördination of the eyes. Yet they are good landers. This group represents, therefore, those individuals who have compensated for their loss of binocular depth perception by the development of accurate monocular depth perception based upon size, motion, parallax, and perspective. As pointed out previously, it appears that most people develop the ability to land an aircraft on monocular clues early in their flying training; also under most flying conditions monocular clues to depth predominate.

(d) *Group IV.* Those with poor ocular muscle balance and who are poor landers.

In this group are those with poor ocular muscle balance or binocular coördination. This may be of recent or long standing. Some authors (Livingston[141, 236]) emphasize the deleterious effect of late-acquired heterophoria.

I feel that, judging the group as a whole, this is a false emphasis, since monocular clues are usually predominant, and because the pilot usually develops an efficiency with monocular factors in depth perception early in his flying training.

Be this as it may, this group has unstable or absent binocular depth perception. Coincidentally it is found that they are poor landers. This group is small as compared to the other three. The Royal Canadian Air Force has no exact data as to their frequency, but circumstantial evidence indicates that they are of an order of frequency less than one percent of all pilots. This is in accordance with the belief expressed by Tostevin,[174] which was mentioned in Section III.

Just as Group II represents Group I with added psychologic or motor difficulties, so Group IV may represent Group III with added psychologic or motor difficulties. For example, the pilot may have poor binocular depth perception due to faulty ocular coördination and be quite an excellent pilot, yet due to flying stress or some minor flying accident he may lose his confidence, and thus fall into Group IV. Livingston[236] recently emphasized this aspect, though he gave little specific data to support his views.

Also in Group IV are those who never have learned to land a plane by making use of monocular clues to depth, but have remained dependent upon binocular clues. Incomplete evidence at the present time tends to indicate that this group is about equally divided in causation between those with psychologic disturbances and those whose depth perception remains dependent upon binocular factors.

Correction of the difficulties of those in this group, therefore, will depend upon the proper assessment of the two subdivisions. Rest and psychologic treatment will be of benefit to those who have a psychologic disturbance, while those with a disturbance of binocular vision will be helped in certain cases by special eye-muscle exercises.

Using these concepts as a basis, certain recommendations relative to ocular muscle-balance standards can be made for use in aviation. Providing there is no frank diplopia, no restrictions in this regard are required for pilot duty. In other words, unless there is a paresis of one or more of the extraocular muscles of recent origin, and of such degree as to produce diplopia, no limitions need be made in regard to ocular muscle balance. Imbalances of sufficiently long standing to be followed by the development of neglect, or suppression, are no bar to pilot duty.

If it be required of the visual standards that they permit the selection of men with a "pilot life" of 10 to 20 years, the problem becomes more difficult to answer on the basis of certain knowledge. As pointed out in Section IV, studies by Adams[107] and Davis[108] indicate that ocular muscle balance may deteriorate with age. This was evident in these studies in respect to exophoria particularly.

More detailed studies, carried out over a longer period of time and using larger numbers of subjects, are necessary before this aspect of the problem can be accurately assessed. It is felt, however, that a gradual deterioration of ocular muscle balance is not likely to have a serious effect upon flying performance.

Also, acute paresis of one or more ocular muscles is no more likely to occur in those with previous heterophoria than in those with orthophoria. Thus, it would appear that even on this basis no restriction regarding ocular muscle balance can be justified.

Some may argue that heterophoria of moderate to high degree is a cause of eyestrain—a possibility which is particularly important to aviation services looking forward to obtaining many years of employment from their personnel. This aspect is not only important in the case of pilots, but in that of all personnel.

It is generally recognized that the relationship of heterophoria to eyestrain is a highly variable one. What apparently causes eyestrain in one person is well tolerated by another. In many, psychogenic aberrations are coëxistent and further complicate the picture. It is very difficult in our present state of knowledge to delineate fully all components of the problem.

Under this set of circumstances, when choosing personnel for long service, the cautious may feel it necessary to set some limit to the permissible amount of heterophoria. To meet this somewhat speculative and special situation, the following limits are recommended:

1. Exophoria and esophoria—not more than six prism diopters at 20 feet.

2. Hyperphoria—not more than one prism diopter at 20 feet.

3. Near point of convergence (objective)—not more than 12 cm.

4. A properly conducted cover test, both for near and far, should indicate at least fair fusion.

As pointed out in Section V, each one of these tests has a certain experimental error. When making assessments of the binocular status of a person, these should be kept in mind.

It is pointed out that these restrictions are purely arbitrary, owing to our present

lack of knowledge. It is not likely that all will agree with them. Probably there will be as many opinions regarding them as there are experts. For instance, one may ask about the status of those with strabismus. It is my opinion that as a group, over a period of years, they are more subject to eyestrain than others. This may be due to the high incidence of refractive errors among such people.

It must be emphasized that these limitations cannot be justified on the basis of flying performance. Restrictions of this order will cause the rejection of about five percent of candidates for pilot duty. Where the source of manpower is great, this wastage is not serious. In wartime, however, limitations based on such speculative considerations cannot be justified.

IX. Summary and Conclusions

1. Three large groups of factors enter into the complex function of the perception of depth in aviation: (a) Subjective or perceptive factors; (b) objective clues to depth which may be of a binocular or a monocular nature; (c) The psychologic attitude or status of the pilot.

2. The perceptive factors are not all applicable to the aviation situation. Those that are applicable may be classified as:

A. *Physiologic factors.* (a) Stereopsis—(1) binocular parallax, (2) physiologic diplopia.

B. *Psycho-physical factors.* (a) Size, (b) motion parallax, (c) perspective (of limited importance).

3. From the subjective aspect of the question: the physiologic factors depend upon binocular vision, while the psychophysical factors are monocular, and their accuracy is developed by experience.

4. From the objective aspect of the question: under most conditions in aviation monocular clues are dominant.

5. The ability to perceive depth is a response to a complex arrangement of the subjective and objective elements already mentioned, and is affected by the psychologic status of the individual.

6. The visual standards for pilot duty from the beginning to the present have insisted upon stable ocular muscle balance on the basis that, if it were defective, pilot performance would be affected deleteriously.

7. There are many well-controlled studies in the literature which indicate that ocular muscle balance may be affected in some cases by marked anoxia or fatigue. Usually, the deviation is toward an increase of exophoria and weakening of convergence. These changes are more marked in those cases in which the ocular muscle balance is poor in the beginning. However, stereopsis is affected only in very few cases. The practical importance of this has disappeared with the development of an adequate oxygen technique during the last war.

8. Aside from the effect of anoxia, there is little or no sound evidence in the literature that good ocular muscle balance or stereopsis is essential to safe flying.

9. The routine tests used by the Royal Canadian Air Force to study ocular muscle balance were found reliable with the exception of the Maddox-rod readings at near and subjective convergence. Studies were carried out to investigate the relationship of the various tests to each other. It also was found that there was no relationship between heterophoria, fusion, and the acuity of stereopsis.

10. It was found at initial-training-school level that, whereas orthophoria was the exception rather than the rule, only very few pilot candidates had an ocular muscle balance outside the permissible standards.

11. Several studies were carried out in the Royal Canadian Air Force to investigate the validity of the present visual standards regarding ocular muscle balance. In only one of the many studies could any relationship be found between flying performance and ocular muscle balance. In this study it was found that candidates with weakness of convergence and/or hyperphoria greater than one prism diopter for near were slightly less likely to

graduate from flying school. This difference though slight was statistically significant.

In all other studies no interrelationship could be found between the degree of heterophoria, binocular fusion, stereopsis, and flying performance. No substantiation could be found for the traditional view that esophorics tend to fly into the ground, while exophorics land high.

12. There is some indication in the literature that orthoptic training may reduce the time to go solo in some individuals. Orthoptic studies in the Royal Canadian Air Force indicated that the use of orthoptics is of little economic value except to salvage personnel. The great difficulty in the application of orthoptics to aviation is to sift the psychologically ill from those having flying difficulty related to ocular muscle imbalance. Psychologic disturbances seemed to play a very large part in the flying difficulties of these cases. Orthoptic training in selected cases gave stable results.

13. An hypothesis is presented to formulate the relationship of binocular vision and depth perception to aviation. Pilots may be divided into the following groups:

A. Those with good ocular muscle balance and who are good landers. There is no necessary relationship between these two characteristics. The selection of such individuals is the aim of present standards.

B. Those with good ocular muscle balance, but who are poor landers. Their landing difficulties are due to some psychic or motor disturbance.

C. Those with poor ocular muscle balance, but who are good landers. Their landings are assisted by the fact that monocular clues are usually dominant. Also they have compensated for any possible defect in binocular vision by the use of the monocular factors in depth perception.

D. Those with poor ocular muscle balance, and who are poor landers. Such cases are very rare. The difficulties in some cases may be due possibly to the absence or deficiency of binocular vision, but in others psychologic difficulties play a large part.

14. On the basis of these findings, it is recommended that no limitations be placed upon ocular muscle balance for pilot duty, providing the candidate has no frank diplopia.

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References

222. Adamson, G. L.: N.R.C. (Canada) No. C-2377, October, 1942.
223. Kane, L. A.: N.R.C. (Canada) No. C-2541, July, 1943.
224. Barr, M. L.: Project V.S. 9, Report to D.M.S./Air, R.C.A.F., December 2, 1942.
225. D.M.S./Air: N.R.C. (Canada) No. C-2955, February, 1945.
226. ——: N.R.C. (Canada) No. C-2791, February, 1945.
227. Sellers, A. H.: N.R.C. (Canada) No. C-2542, June, 1943.
228. McCulloch, C., and Crush, M.: Arch. Ophth., **36**:171, 1946.
229. Schwichtenberg, A. H.: J. Aviation Med., **10**:44, 1939.
230. Nicholls, J. V. V.: N.R.C. (Canada) No. C-2549, December, 1942.
231. Nicholls, J. V. V., and Minnes, J. F.: N.R.C. (Canada) No. C-2544, July, 1943.
232. Nicholls, J. V. V.: Report to D.M.S./Air, 1944.
233. Beccle, H. C., and Kitching, E. H.: Brit. J. Ophth., **29**:125, 1945.
234. Imus, H. A.: U. S. Naval School of Aviation Medicine and Research, Naval Air Station, Pensacola, Florida. Project No. X-395 (Av-213-k), June, 1947.
235. Nicholls, J. V. V.: J. Canada M. Services, **2**:267, 1945.
236. Livingston, P. C.: Tr. Ophth. Soc. Australia, **6**:60, 1946.

GRENZ-RAY IRRADIATION OF VASCULARIZED RABBITS' CORNEAS*

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The present study of radiation in treating corneal blood vessels was undertaken in an effort to provide an effective means of reducing blood vessels in corneal scars. This alone has been shown to improve the transparency of scarred corneas in many instances. In additon, the reduction of vascularization is necessary in many cases before corneal transplantation can be done successfully.

We conducted experimental studies on rabbits and at the same time patients were treated with various types of radiation. The rabbit studies are reported herein and the results obtained with human cases will be reported at a later date.

The type of radiation that was used consisted of soft Grenz rays. Vascularization was induced by chemical burns with acid or alkali.

LITERATURE

Grenz rays are the least penetrating X rays, with a wave length of 1.5 to 2.0 Angstrom units, and exert powerful effects on the most superficial layers of the tissues. Their energy is almost entirely absorbed in the first two mm. of the skin. The biologic effects of these rays were reviewed by Bucky,[1] 1947. These include the production of erythema and a temporary drop in leukocytes in the circulating blood. Myleus,[2] 1928, reported that the cornea of an eye treated with Grenz rays is more easily stained with fluorescein; the fluid metabolism of the eye is not influenced to any appreciable extent; artificial epithelial defects or infected ulcers of the cornea heal more rapidly and with finer, thinner scars than in nonradiated eyes; and artificially induced corneal tuberculosis is influenced by Grenz rays.

Erggalet,[3] 1930, reported that Grenz-ray treatment of the rabbit eye produced a migration of pigment into the cornea which disappeared spontaneously after a long time.

Krasso,[4-6] 1930-1932, reported good results from the treatment of superficial corneal lesions of various types with Grenz rays. This author demonstrated in rabbits' eyes that the effect of Grenz rays was limited to the superficial one third of the cornea; that in the case of rodent ulcer, Grenz rays hastened disintegration of leukocytes, retarded division of the lymphocytes and the development of the proliferating fixed tissue cells.

Thompson and others,[7] 1937, showed that the local formation of precipitins in the cornea, following the injection of purified egg albumin, was increased by exposure to dosages of Grenz ray. Friedenwald and Buschke,[8, 9] 1947-1948, showed that Grenz rays greatly inhibited cell division in the corneal epithelium and that thermal burns made eight days after a single irradiation healed more slowly than normal. Smelser and Pfeiffer,[10] 1948, showed that cell mitosis was inhibited after exposure to Grenz rays.

The experimental production of corneal vascularization has been treated in the literature mostly in connection with nutritional deficiency states. Anderson and Milam,[11] 1945, studied a large number of humans with nutritional deficiencies and found no correlation between riboflavin level of the diet, riboflavin deficiency, and corneal vascularization.

Sydenstricker,[12] 1946, reported on a study of 200 inhabitants of Holland at a time when 10 percent were suffering from famine edema. None of them showed corneal vessels.

L. L. Bowles and others,[13] 1946, noted

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spontaneous appearance of vessels in rats' corneas as the animals age. This vascularization does not regress with the administration of riboflavin. In riboflavin-deficiency states, conjunctival edema and congestion of limbal vessels lead to capillary sprouts that spread into the cornea. In 7 to 10 days, the edema subsides and the cornea is extensively vascularized.

In vitamin-A deficiency states, xeropthalmia occurs followed by vascularization. The pattern of blood vessels in vitamin-A deficiency consists of very small branching capillary networks. In riboflavin deficiency, capillaries are less numerous and anastomose less frequently. Sydenstricker and others,[14] 1947, found that deficiency of any of the essential amino acids may result in corneal vascularization in the rat.

Method

Vascularization of the cornea was produced by the application of 30-percent sulfuric acid to a five-sq.-mm. area of the rabbits' corneas, starting at the limbus at the 12-o'clock position. A cotton-tipped applicator was dipped in the acid, and the excess squeezed out. The rabbit's eye was previously anesthetized with topical pontocaine. The applicator was held in contact with the cornea until a degree of relucency developed which, based on experience, would produce vascularization without perforation. Both eyes were treated in each rabbit; the one for control purposes.

As the healing process was observed, it took 5 to 7 days for macroscopically visible blood vessels to appear in the cornea. A main vessel would grow into the normal cornea just posterior to the burned area and would extend to the boundary of the injury. This vessel would send branches in both directions. A similar vessel developed at the same time anterior to the burn and progressed in the same manner.

The burned cornea slowly healed so that the edematous relucent area became a scar during the next seven days. During this process another main vessel usually grew from the limbus into the center of the scar. In the subsequent months, the regularity of the pattern of the blood vessels gradually diminished.

Grenz rays were administered to the rabbits' eyes at the limbus over a field of one cm. in diameter. The factors used were 10 K.V.; 8 ma.; 8 cm., T.S.D.; Hvl. of 0.04 mm. Al.

In six rabbits comparable areas were burned with sulfuric acid on each eye The one was used for a control and the other was treated with 500 r daily for five days beginning on the day of the acid burn. The period of observation was three months and there was no significant difference between the treated eyes and the controls.

In one rabbit, 1,000 r was used daily for three days beginning with the day of the acid burn. This delayed vascularization two days as compared with the control.

In one rabbit, 1,250 r was used daily for two days. This delayed vascularization three days as compared with the control eye.

One animal received 2,500 r as a single treatment on the day of the acid burn. This delayed vascularization three days.

A single dose of 4,500 r on the day of the burn delayed vascularization for five days, but a control normal cornea developed infiltration and vascularization as a result of the radiation.

Three animals received five successive daily treatments of 1,000 r beginning the third day after the acid burn. Vascularization was delayed in one for five days (but then grew in more abundantly than the control). One was delayed two days and the third was not delayed at all.

Two animals received two treatments of 2,500 r each on successive days beginning the day of the acid burn. In one vascularization was delayed two days, in the other not at all. An unburned cornea was also given 2,500 r on two successive days and developed a corneal infiltrate which persisted, but did not vascularize. One animal received 2,500 r

each day for two days, the third and fourth day after the burn. This delayed vascularization by two days as compared with the control.

Three rabbits were treated each with 5,000 r in a single treatment. In one, the treatment, applied the same day as the acid burn, delayed vascularization two days. Another received the treatment three days after the acid burn; this also delayed vascularization two days. The third one was a control eye with a normal cornea. This developed an infiltration which persisted throughout the period of observation (three months). Infiltration in addition to the vascularized scar characterized the delayed outcome of the first two in this group.

Comments

Since Grenz rays are known to penetrate only about 3 to 4 mm. of tissue (88 percent of the rays being absorbed in the first three mm. of tissue), they would seem to be the ideal electromagnetic radiation to be used on the corneas if any would be effective. Their range of effectiveness is in the zone of the cornea where we had created blood vessels, and they do not penetrate sufficiently to be dangerous to the lens.

Apparently the limit of tolerance of the rabbit cornea for Grenz rays is approximately 4,000 r given in a single dose. Greater dosages than this produced evidence of damage, that is, infiltration, vascularization, opacification. Various time intervals were chosen for the application of the rays within the period that the capillaries were known to be forming and the time factor was apparently also not the critical one. Even with doses up to 5,000 r applied either in divided doses or in a single dose, the vessels were not significantly affected.

Results

From these experiments we conclude that Grenz rays are not effective in reducing the vascularization of corneas in rabbits. Doses that are sufficient to cause a superficial corneal burn are insufficient to cause obliteration of blood vessels.

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References

1. Bucky, G.: Grenz (infra-roentgen) ray therapy. Am. J. Roentgenol., **17**:645, 1927.
2. Mylius: Ueber die Wirkung von Bucky Strahlen (Grenzstrahlen) auf des Auge des Kaninchens. Ztschr. f. Augenh., **64**:316, 1928.
3. Erggalet, H.: Zur Trage der Strablenwekung am Auge. Deutsche Ophth. Ges., Heidelberg, 1930, p. 245.
4. Krasso, I. Die Behandlung der Erkraukungen des vorberen Bulbus abschirittes mit Bucky's Grenzstrahlen. Ztschr. f. Augenh., **71**:1-11, 1930.
5. Krasso, I.: Experimentelles und Histologisches über den Einfluss Bestrahlung mit Bucky's Grenzstrahlen auf des kesunde Kannechenaige. Ztschr. f. Augenh., **70**:237, 1930.
6. ———: Ueber Bosartige Randgeschwure der Hornhaut (abortive formen des ulous rodeus) und deren Besinflussung durch die Grenstrahlen. Ztschr. f. Augenh., **77**:182, 1932.
7. Thompson, R., Pfeiffer, R., and Gallardo, E.: Stimulation of local antibody formation in the cornea by Grenz rays. Proc. Soc. Exper. Biol. & Med., **36**:179, 1937.
8. Friedenwald, J. S., Buschke, W., et al.: Some effects of sulfur and nitrogen mustards on cell nuclei in mammalian cornea. Approaches to Tumor Chemotherapy, 1947, pp. 358-378.
9. Friedenwald, J. S., et al.: Comparison of the effects of mustard, ultraviolet and x-radiation, and colchicine on the cornea. Bull. Johns Hopkins Hosp., **82**:312-325, 1948.
10. Smelser, G. K., and Pfeiffer, R. L.: Influence of Grenz rays on cell division and wound healing in corneal epithelium. Arch. Ophth., **39**:1-8, 1948.
11. Anderson, R. K., and Milam, D. F.: Biomicroscopy of the eyes in evaluation of nutritional status: Corneal vascularization. J. Nutrition, **30**:17 (July) 1945.
12. Sydenstricker, V. P., et al.: Amino acid and protein deficiencies as causes of corneal vascularization: A preliminary report. Science, **103**:194-196 (Feb.) 1946.
13. Bowles, L. L., et al.: The development and demonstration of corneal vascularization in rats, deficient in vitamin A and riboflavin. J. Nutrition, **32**:19-35 (July) 1946.
14. Sydenstricker, V. P., et al.: The corneal vascularization resulting from deficiencies of amino acids in the rat. J. Nutrition, **34**:481-487 (Nov.) 1947.

ANOMALOUS CORRESPONDENCE

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Anomalous correspondence has many synonyms—abnormal correspondence, abnormal retinal correspondence, anomalous retinal correspondence, abnormal sensorial relationship, false projection, abnormal binocular projection, false fovea, incongruous retinas, false associated fixation, secondary correspondence, and anomalous retinal projection. I prefer to use anomalous correspondence because I consider it broad enough to describe a cerebral act which associates two noncorresponding areas in the retinas so that a single image is visualized by the squinter. Terms which include the word, retinal, are too limiting and might give the impression that the relationship arises and exists only in the eyes themselves, without taking into account that the abnormal association is really cerebral, stimulation of two noncorresponding retinal areas being only a part of the whole process.

Cass,[1] in 1938, gave an interesting historical survey of the work of the earlier students of anomalous correspondence in the 18th and 19th centuries. It is in this article that we find Von Graefe's famous remark to Javal, "People are not worthy of so much trouble."

There is certainly no more troublesome problem in orthoptics than a stubborn anomalous correspondence, but there is also no more satisfying situation than a true correspondence which has been established where anomalous correspondence previously existed, and I am sure that even von Graefe would agree that such a result is really worth the effort.

Many writers list anomalous correspondence as one of the obstacles and pitfalls in the treatment of squint; among them, Costenbader,[2] Feldman, Hitz, Allen, Ellett, and Lancaster. This is certainly true since, if surgery is contemplated and anomalous correspondence is present, the chance of establishing postoperative binocular vision is greatly reduced.

Burian[3] gives a comprehensive definition of anomalous correspondence. "Anomalous correspondence is an attempt of the organism to adapt the sensorial condition of the visual apparatus to the anomalous motor condition in an attempt at a restoration of the binocular coöperation."

As we say to the mother, the child has tried to use his eyes together as if they were straight when they are turned, and he has, therefore, built up wrong habits and associations which we have to correct by retraining.

Lancaster[4] says, "Retinal correspondence is not an anatomic peculiarity innate and unchangeable. In squint, anomalous correspondence frequently develops. In this condition a different point of the retina of the squinting eye acquires a more or less perfect correspondence with a point of the nonsquinting eye. This is secondary correspondence, or anomalous correspondence."

Adler and Jackson[5] give this classification of anomalous correspondence.

"1. The fixing macula is associated with that part of the retina of the squinting eye on which the image customarily falls, and the projection of these two images in space is the same—harmonious. It is infrequent and the only type in which some form of binocular vision occurs under normal conditions.

"2. The macula of the fixing eye is associated with a point on the retina of the squinting eye between its macula and the point where the image customarily falls—unharmonious.

"3. A state without functional correspondence (the most frequent), since suppression of the nasal area of the squinting eye is so widespread that no particular area of it is found to correspond directionally with the fixing macula. Differs from other types only in the amount of suppression."

Frequency of anomalous correspondence

Statistics on the frequency of anomalous correspondence vary according to the selection of cases. A survey of the literature shows the findings of a number of authors to be: Feldman, 14 percent private patients, 30 percent clinic; Ellett, 36 percent; Davis, 35 percent; Smith, 50 percent; Travers, 56 percent to 65 percent; Brooke, 45 percent; Dicke and Hitz, 57 percent; Hardy, 60 percent; Fowler, 50 percent; Berens, 61 percent; Fischer, 50 percent; Hine, 71 percent; Muegge, alternators, 61 percent, monocular, 27 percent; Adler and Jackson, 64 percent; Pugh, 42 percent.

An average of these findings gives an overall incidence of 47.5 percent of anomalous correspondence.

A study of 295 squint cases, checked routinely in the Vanderbilt Eye Clinic of Presbyterian Hospital, showed 133 (45 percent) with anomalous correspondence and 162 (55 percent) with true correspondence; 229 of the total were esotropias of which 123 (53 percent) showed anomalous correspondence; 66 were exotropias of which 10 (16 percent) showed anomalous correspondence. These statistics are based on major-amblyoscope findings.

Congenital or acquired

Whether anomalous correspondence is congenital or acquired has not been proven. Verhoeff[6] wrote in 1938, "Whether anomalous projection represents an hereditary reversion to a more primitive type of sensory relation or is acquired entirely by experience remains to be determined."

Unfortunately the age of onset in the great majority of squint patients is too young to permit determination of the state of correspondence when the squint first begins. My experience to date would lead me to believe the condition is acquired. Occasionally, however, one finds an adult with a case of untreated squint that would seem to have been ideal for development of anomalous correspondence, yet all tests show normal correspondence.

Moncreiff,[7] in 1929, stated that abnormal correspondence is not congenital but acquired and seems to be an effort toward adaptation of the sensoric relations to the squinting position. The fact that, in an occasional case of squint, normal correspondence will develop spontaneously after surgery when anomalous correspondence was present before the operation would seem to favor the opinion that anomalous correspondence is acquired.

Methods of testing

There are three main areas in which the state of correspondence can be tested: the major amblyoscope, the after-image test, and measurement of the separation of the two images in diplopia.

The major amblyoscope is the instrument on which all orthoptic technicians depend and it is usually possible to get a fairly good idea of correspondence in children between the age of three and four years, although children vary tremendously in their ability to comprehend and describe what they see. The after-image and diplopia tests usually cannot be done in patients much younger than six years of age, in my experience.

Roth[8] gives a very good description of the way to obtain findings on a young child: "On the second or third visits we usually attempt to obtain the measurement of squint and the kind of retinal correspondence on the major amblyoscope. Needless to say, this is not always possible in the case of a child under three years. With such fascinating targets as the lion and the cage, the butterfly and the net, the spider and the web, or the bird and cage, we let the child show us where he puts them together, and then quickly flash to determine if the simultaneous macular perception is at his objective angle. If we stimulate the child, in the spirit of fun, to show us how good he is, we can usually determine in repeated attempts if he is actually telling

us what he sees or merely attempting to please. In the beginning, we generally find the child eager enough, and yet not too much aware of what he is supposed to see, to obtain the correct answers without much checking on our part. Of course, our flashing to determine the type of correspondence must be quick, as the child's concentration at this age is always poor, despite his eagerness and interest. No findings can be relied upon at this time unless they are corroborated on repeated attempts."

Testing on the major amblyoscope consists of first finding the objective angle; that is, flashing the lights on and off alternately before each eye while the patient looks at a central spot on each slide while the tubes of the machine are adjusted until there is no longer any motion as fixation is shifted from one eye to the other and back. We then want to know if the objective and subjective angles coincide.

To obtain the subjective angle one needs to know whether the patient sees the two images superimposed or separated, and one must be careful not to give him a hint of what we except. Do not say "Is the lion in the cage?" Instead say: "Where is the lion, in or out of the cage?" If the child replies "in," but one questions this answer, move the lion 10 to 20 diopters away and ask the child to take the handle of the tube himself and move the lion until it gets in. In this way we can tell quickly if he has selected the same angle as the one found with the objective test.

If the lion is described as "out," say: "Which side of the cage? This side?", touching the child's right hand or shoulder, "Or this?", touching his left hand or shoulder. Try to get him to signal with his hands on the table, as the young child will try to bring his hand up close to the instrument and point into the eye piece. Most children, however, do quite well in interpreting relative location. Many will see, with a little help, the area of suppression which is usually found as the tubes are moved from the objective to the subjective angle. The older child will sometimes say "He should be in about now, but he has gone away."

The difference between the objective and subjective angles is the angle of anomaly. It is harmonious if the angle of anomaly equals the angle of squint; for instance, if a child measures an esotropia of 30 diopters objectively but the subjective angle is zero. It is unharmonious if the angle of anomaly is less than the angle of squint; that is, for example, if the child measures an esotropia of 30 diopters but the subjective angle is 15 diopters.

Many technicians, I among them, consider a difference of more than five diopters between the objective and subjective angles an indication of anomalous correspondence. Smith[9] states that a difference of two to five prism diopters is within normal limits.

In the use of the major amblyoscope one of the most important things to watch is the corneal reflex. As Wells[10] points out, a child may have a rather varying angle due to an accommodative factor or a breaking up of fusion which may cause a shift, but if the patient is carefully observed one will note that at his subjective angle the two corneal reflexes are centered. To make a diagnosis of anomalous correspondence on the major amblyoscope the corneal reflex must be eccentric in one eye at the patient's subjective angle.

Lyle,[11] in 1939, stressed the fact that the ability to diagnose the presence of abnormal correspondence is most important because of real harm that can be done by a course of orthoptic treatment in which binocular stimulation is given at the subjective angle of squint with an anomalous correspondence.

We find an occasional patient who measures a quite definite anomalous correspondence with first-grade targets, usually showing a difference of 10 to 15 diopters in the two angles, and yet can go on and do fusion slides at the objective angle. We have even had a few patients who claimed depth perception.

Brooke[12] describes such a condition, "although simultaneous perception remained

rigidly false, yet many children could superimpose fusion slides correctly at the objective angle." Mann[13] is evidently describing the same situation when she states, "One finds that in anomalous projection of recent origin, a pair of unlike pictures . . . will be perceived as widely separated when placed one in front of each eye while a fusible pair of pictures may be not only fused, but seen stereoscopically."

I have found that those children who have true correspondence with fusion slides but anomalous correspondence with dissimilar slides usually show true correspondence with the after-image, pointing to an anomalous correspondence which is less deep-seated.

The after-image test, associated with the names of Hering and Tschermak and Bielschowsky,[14] because of their use and descriptions of it in the literature, is helpful in many instances, though in my experience it is difficult for a child younger than six years of age to understand and interpret.

The test is done by presenting a streak of light with a space and fixation spot in the center horizontally to one eye, then vertically to the other eye while the opposite eye is completely occluded. I have the child use the palm of his hand not the fingers to occlude so that no light can get in, and count slowly to 15. The test does not have to be done in a completely dark room, but no other bright light should be on. If the patient has trouble in perceiving the after-image a light flashed on and off rapidly a few times will often help.

Always present the vertical line to the nonfixing eye and present this second, giving the horizontal line to the dominant or fixing eye first. The vertical line is easier to see and, if it is presented last, will make the visualization easier for the nonfixing eye.

No matter how high the angle of squint, with true correspondence the patient will draw a cross. With anomalous correspondence he will draw the vertical line shifted to the right or the left of the horizontal line.

There are two types of after-images, positive (as seen in a darkened room) which the patient quite often describes as pink or green, and negative (as seen in a lighted room) usually seen as dark lines.

Burian[3] describes the way in which the angle of anomaly can be measured by means of the after-image test. With the length of the filament known and the patient a known distance from the filament, the angular size of the filament relative to the eye can be computed.

The Wottring Instrument Company has a pair of slides (number SM 2A and 2B) designed to do the after-image test in their major amblyoscope (the Troposcope). Both slides are made with a solid black background with the exposure areas blank for the light to shine through the glass. One slide has a horizontal line about two-mm. wide with a gap in the middle in which there is a small dot, and the other slide has a vertical line the same size as the horizontal with a small dot in the gap in the center. The lights on the Troposcope are turned to the brightest point, before each eye in turn, with the same technique as used with the filament of a bulb. I have found the Wottring slides very satisfactory. Compared with the filment arrangement I seem to get better answers from the younger children. The slides are more convenient since they can be shown to the child when seated at the same instrument on which his other tests are being done.

My favorite story about the after-image was told by a New York oculist who was administering the test with great care to a young boy. He finally said, "Now, Sonny, close your eyes and tell me what you see." The boy closed his eyes and with a smile on his face said "Cowboys and Indians!"

The double-image or diplopia test is done by comparing the patient's angle of squint as measured by the prism-cover test for a set distance with the amount of displacement measured with a red glass or a Maddox rod.

Burian describes the use of the tangent scale in this connection. He also feels that one should always attempt to perform the test by covering first one eye and then the

other and comparing the answers received. The red glass should be used first in front of the eye which the patient habitually uses for fixation, as it is easier to elicit double images by dimming the image of the dominant eye first. If this fails, a prism of about 10 diopters base-up or base-down in front of one eye usually will displace the image enough so that the patient becomes conscious of the diplopia.

Lancaster's red-green test can also be used to measure the diplopia. The patient wears red-green spectacles (red over the right eye) and, if he is to fix with the right eye, uses the green flashlight projector to place his spot on the spot made by the red flashlight projector which the examiner handles. If the patient is to fix with the left eye, the projectors are changed and he holds the red projector. The amount of separation of the two lights, compared with the amount which should be shown with a given amount of squint shows the subjective angle of anomaly.

Concerning the various tests for correspondence, I agree with Duke-Elder[15] when he says, "the confusion is rendered greater by the underlying fact that we do not know what we are measuring but are certain that we are measuring different things with different tests."

Treatment

The treatment of anomalous correspondence consists of teaching the patient true correspondence by arousing in him an appreciation of the correct relationship of his two foveas at his objective angle.

Lancaster,[16] in describing retinal massage, says: "My principal method is simultaneous stimulation of corresponding areas by very rapid motion: I lock the arms of the synoptophore at the patient's objective angle of deviation and move them as fast as necessary to get the patient to project the targets in the same direction; that is, see the lion in the cage. In this way both maculas are stimulated by a method calculated to arouse conscious perception of both images. The speed of movement is gradually decreased until none is needed, and practice in finding the 'true direction' subjectively is introduced. From this stage I add fusion practice until the patient has reliably true responses on both simultaneous perception (unlike) and fusion (like) targets."

Another method of treatment is setting the major amblyoscope at the objective angle and stimulating with very rapid flashing. I cannot recommend this as I have never had any luck with it, perhaps because I have never had a mechanical flasher, and manual flashing does not bring results for me.

There are several other methods of treatment which have been described by different technicians. Mann[12] finds modified chasing useful. She teaches the patient that, at the true angle, the pictures are clearest though separated. The orthoptist moves one tube and the patient moves the other to the clearest position. One cannot do this exercise if the patient goes to the subjective angle.

Mayou[17] found that the larger the pictures the more difficult it was for the patient to detect small errors in vertical deviation, and the less accurate he was in his answers—therefore much smaller pictures were used. The second step was to transfer the actual operation of the synoptophore to the patient, as this would hold his attention. A very small picture of a house or a slightly larger picture of a ball is used to fix the fovea of one eye. For the other eye, there are four slides, each one with a box progressively smaller than the previous one, so that the maximum area of movement of the box about the house varies from 10 degrees down to three degrees. In addition, the largest box has three small boxes in a row into which the house will just fit. The patient fixes on the house and, starting with the targets in homonymous position, moves the box from one side of the house to the other, thus overcoming suppression. I have found this type of treatment very helpful with a coöperative patient.

Walraven[18] has developed a monocular diplopia technique which has much to offer as

a source of variation in the training. She uses this method on alternating strabismus where the visual acuity in each eye has reached foveal development. Monocular diplopia is not elicited in every instance though that is the goal. For classification and treatment, she divides the cases into two groups—positive and negative. The positive group is the one in which superimposition actually takes place at the subjective angle; with these monocular diplopia will be manifested. It has not been found in the negative group which manifests only crossing at the subjective angle. This technique can be used with the negative group except that strong suppression will be expected rather than monocular diplopia.

Miss Walraven begins by setting the arms of the instrument where it is possible for only alternating foveal fixation to take place. The eye which first shows an eccentric light reflection at the subjective angle must become the fixating eye. If a convergent squint has an objective angle of 45 prism diopters and a subjective angle of 15 prism diopters (an angle of anomaly of 30 prism diopters), the instrument is set 15 diopters on the divergent side (base-in). The smaller of two macular targets is used before the eye which is to fix and at 15 base-in. The larger target is used before the preferred fixating eye and placed at zero. At this point one checks to be sure the patient can alternate on the targets, then only the smaller target is fixated.

Gradually the arm of the amblyoscope with the smaller target is brought toward the subjective angle as long as the foveal fixation of the smaller target is maintained. If fixation on the smaller target is lost, the light is turned off before the larger target to force fixation on the smaller target. If foveal fixation of the smaller target cannot be maintained when both the lights are on, the smaller target is returned to the divergent side until fixation is regained with the smaller target. At the subjective angle the patient is instructed to look to the left of the smaller target and find another one just like it. In the positive group when foveal fixation is maintained at the subjective angle with the smaller target, monocular diplopia usually occurs.

After spontaneous, alternating foveal fixation can be maintained at the subjective angle, the smaller target is gradually brought through the subjective angle and the angle of anomaly to the objective angle. The larger target is brought toward the objective angle at intervals along with the smaller target but it is not moved as often. The mental stimulus required for the treatment prevents fatigue and monotony for both technician and patient. It is possible to work a long time with one slide as the patient is busy learning to adjust to a new situation.

Miss Walraven finds that the number of visits required to elicit monocular diplopia and correct the anomalous correspondence is six. Daily visits of 30 to 45 minutes are best, though visits two or three times a week have proved successful. About six additional visits are necessary to consolidate the situation. Complete occlusion of the fixating eye is necessary. In alternating strabismus there is usually a preference for one eye, even though it may be slight. Miss Walraven has developed a set of six pairs of slides especially designed to suit her technique; all have macular and foveal controls.

I find that patients respond to this treatment and find it interesting. Most important of all, it brings results.

Prognosis in a particular case is difficult. I believe that the chances of breaking down the association are good when the patient has developed the squint after four years of age; that the chances are much less if he has squinted from birth. I get the best response in the five-to-seven-year group. Intermittent squints respond much more quickly to treatment than those with a fixed angle. The patients who can get monocular diplopia quite easily respond much more rapidly.

The use of complete occlusion of one eye during treatment is generally practiced and accepted. Barstow,[19] Drye,[20] and Swan[21] have

stressed its use. Brooke[12] could not be sure whether occlusion helped to shorten treatment. I am inclined to use occlusion in all the cases in which it is possible. If for one reason or another, however, it cannot be carried out, I still feel that treatment is worth trying. Some of the patients have done surprisingly well without occlusion.

I do not believe in treating anomalous correspondence for weeks and months unless there is some sign of response. The average patient will show signs of improvement in the first six visits if he is ever going to do so. Hare[22] considers it uneconomical to give more than 12 preoperative training visits, as most cases respond by this time. Although she feels it preferable to overcome anomalous correspondence preoperatively she has "found that most cases respond to treatment far quicker after operation."

I am sure we all agree with Swan[21] on the importance of immediate postoperative orthoptics "before the anomalous correspondence adapts itself to the new deviation."

In general I believe that attempting to break down a deep-seated anomalous correspondence in a patient in the teens and older is a discouraging and sometimes a dangerous process. I have seen at least one teen-age patient, who had by intensive training established a normal though unstable correspondence preoperatively, return to anomalous correspondence postoperatively and end with a constant diplopia—a very annoying one as the two images were so close that they overlapped. The patient had to resort to constant occlusion to be comfortable.

Duke-Elder[15] believes that "training should not be considered in adults unless there is evidence that normal binocular vision at one time existed." Pemberton[22] expresses it this way, "We hesitate to treat adults with apparently no latent binocular function for fear of giving them diplopia to no ultimate purpose." Ward[24] states that in "treatment of a squint in an adult" she feels "an abnormal retinal correspondence is contraindication to preoperative treatment because of the danger of postoperative diplopia." These opinions certainly should be weighed and considered carefully before starting treatment.

Just what effect a fixed anomalous correspondence has on the end result in surgery has yet to be determined. Dicke[28] found, in a series of surgical cases at Milwaukee Children's Hospital, a correction of 85 percent of the deviation in the patients who had a normal retinal correspondence as compared to 69 percent correction of the deviation in those who had an anomalous correspondence.

The oculist should know the state of retinal correspondence (if it is possible to obtain it) in a patient on whom he is considering surgery. I believe some operators feel it is safer to undercorrect an esotropia with anomalous correspondence because of the danger of a postoperative divergence as one adjustment the eyes may make if binocular vision is not established.

Summary

In this paper I have attempted a general survey of anomalous correspondence. I have considered the terminology, definition, and classifications, and have cited statistics gathered from the literature showing an over-all average of 47.5 percent. A study of 295 squint cases checked in the Vanderbilt Eye Clinic of Presbyterian Hospital showed 45 percent with anomalous correspondence. The question of whether anomalous correspondence is congenital or acquired is considered.

The methods of testing correspondence with the major amblyoscope, the after-image test, and double-image testing are described.

The treatment of anomalous correspondence on the major amblyoscope may employ various methods, retinal massage and flashing, as well as individual techniques.

Prognosis is best in a squint which developed after four years of age, in the five-to-seven-year age group, if the squint is intermittent and if the patient gets monocular diplopia easily.

The use of complete occlusion of one eye

during treatment is recommended. A series of six orthoptic visits is recommended to see if there is any response. In general, it is suggested to continue only with those patients who show some sign of reaction to the treatment. The treatment of teen-age and adult patients is not recommended as routine procedure; each case should be very carefully considered because of the danger of developing a diplopia. The importance of the effect of anomalous correspondence on end results in surgery has yet to be determined, but the state of the retinal correspondence is one aspect of the case which the oculist will wish to know in deciding on surgery.

There is probably no aspect of the treatment of squint which needs as much patient persistent investigation as anomalous correspondence, and we hope that unremitting efforts in the next decade may give us better answers regarding the development, diagnosis, and treatment of anomalous correspondence.

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References

1. Cass, E. E.: Abnormal retinal correspondence. Tr. Ophth. Soc. U. Kingdom, **58**:276, 1938.
2. Costenbader, F. D.: Causes of failure in the treatment of squint. Am. J. Ophth., **28**:1123, 1945.
3. Burian, H. M.: Sensorial retinal relationship in concomitant strabismus. Tr. Am. Ophth. Soc., **43**:373, 1945.
4. Lancaster, W. B.: Terminology in ocular motility and allied subjects. Am. J. Ophth., **26**:122, 1943.
5. Adler, F. H., and Jackson, F. E.: Correlations between sensory and motor disturbances in convergent squint. Arch. Ophth., **38**:289, 1947.
6. Verhoeff, F. H.: Anomalous projection and other visual phenomena associated with strabismus. Arch. Ophth., **19**:663, 1938.
7. Moncreiff, W. F.: Disturbances of visual functions in concomitant convergent squint. Arch. Ophth., **2**:179, 1929.
8. Roth, E. V.: Orthoptics for the infant squint, one to four years old. Am. J. Ophth., **27**:57, 1944.
9. Smith, M. T.: Significance of false projection in treatment of squint. Arch. Ophth., **21**:990, 1939.
10. Wells, L.: Orthoptic fictions and misconceptions. Am. J. Ophth., **28**:890, 1945.
11. Lyle, W. H.: Symposium on orthoptic training. Tr. Ophth. Soc. U. Kingdom, **59**:491, 1939.
12. Brooke, M.: Some observations on treatment of abnormal retinal correspondence. Brit. Orthop. J., **5**:66, 1948.
13. Mann, D. S.: Orthoptic treatment of anomalous projection. Brit. J. Ophth., **27**:215, 1943.
14. Bielschowsky, A.: Application of the after-image test in the investigation of squint. Arch. Ophth., **17**:417, 1937.
15. Duke-Elder, W. S.: Textbook of Ophthalmology. St. Louis, Mosby, 1949, p. 3887.
16. Lancaster, J.: The orthoptic treatment of alternating squint. Am. J. Ophth., **25**:866, 1942.
17. Mayou, S.: A new method of developing normal retinal correspondence. Brit. Orthop. J., **4**:35, 1947.
18. Walraven, F.: Personal communication.
19. Barstow, K.: Occlusion. Brit. Orthop. J., **1**:54, 1939.
20. Drye, L. B.: Precautions necessary in orthoptic training. Am. J. Ophth., **27**:1422, 1944.
21. Swan, K. C.: Definition of anomalous retinal correspondence. Am. J. Ophth., **28**:58, 1945.
22. Hare, B.: A few notes on experimental treatment for abnormal retinal correspondence. Brit. Orthop., **2**:36, 1944.
23. Pemberton, E. C.: Prognosis of post-operative diplopia in adult squints. Brit. Orthop. J., **2**:33. 1944.
24. Ward, P.: Selection and orthoptic treatment of adult cases. Brit. Orthop. J., **5**:78, 1948.
25. Dicke, D. E.: Anomalous retinal correspondence. Am. J. Ophth., **25**:585, 1942.

Discussion

Michel Loutfallah, M.D.
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In the field of orthoptics, anomalous correspondence is probably the most controversial subject. Not a single point connected with it but has been argued. Miss Enos has

given a fine and open-minded presentation. Her paper reflects wide experience and will be referred to many times by students in the field. It adds the touch of everyday technique to the masterly thesis of Hermann Burian,[1] to the eloquent teachings of Kenneth Swan,[2] and to the epoch-making Iowa symposium.

Among the 10 names found in the literature the choice of anomalous correspondence is a good one,[3] although I would prefer that of anomalous correspondences, thereby pointing more clearly to the triple—motor, retinal, and proprioceptive—correspondences involved in the secondary psychoretinal relationship in some heterotropias.

A great discrepancy is noted in the frequency of detection of this anomaly in different regions, by different examiners, and by various methods.

Last year, while visiting the orthoptic department of Moorfields Hospital in London, Miss Sheila Mayou gave me to understand that the cases of anomalous correspondences seen by her were extremely few. She diagnosed the condition with her own targets, described by Miss Enos.[4]

Her statistics appear to be completely in contrast with my own. In my cases, anomalous correspondences have been noted in more than 85 percent of the nonaccommodative heterotropias. In these cases I include all the so-called "lack of correspondence" cases which I consider as partially developed and unstable anomalous correspondences but which are likely to be, in time, more fully established.

Typical of lack of correspondence are the "crossing" cases in which the angle of anomaly is demonstrable when strong stimuli are applied on the marginal suppression areas. Also considered as anomalous are the cases mentioned by Miss Enos which are fusing similar targets at the objective angle but which show a discrepancy between the subjective and objective angles for dissimilar targets.

Between recognizing a clear-cut cross of the after-image of the Tchermak test and seeing "cowboys and Indians," young and older patients may experience sensorial impressions too confusing to be adequately reported, since they baffle at times even a keen and trained observer. Other tests mentioned are more reliable, but none should be considered as a sure test for the detection of normal or abnormal relationship.

The orthoptic treatment of anomalous correspondences, which can be carried on in selected cases without the further need of surgery, is well described by Miss Enos. Constant occlusion is preferred for breaking binocularity and as an antisuppression device, although suppression is probably present in this very binocularity. Better relationship is obtained by light flashing and oscillating techniques on the synopto-type instruments. Finally, if or when monocular diplopia is elicited, it may help to bring forth to consciousness the foveal image, leaving the third image to be lost in unawareness.

A point I should like to discuss is the relationship of orthoptics to surgical corrections in heterotropias with anomalous correspondences. From my past training and acquired experience, I have always felt that the judicious combination of both orthoptics and surgery is an invaluable asset. Patients do not get crippling diplopias following the correction of anomalous correspondences when a few elementary rules are adhered to. I have seen more disturbing results when, following surgery on vertically acting muscles, a cyclotropia ensued in what otherwise would have been a prefectly normal sensorial relationship.

Before attempting a correction on a teenage or older patient, it is always advisable to determine the degree of coöperation which can be expected. In this respect one should not underestimate the deleterious effects on the patient's or the family's attitude and behavior by entirely gratuitous training, as exemplified by many cases under social agency sponsorship.

The treatment of anomalous correspondences should be undertaken only after full

understanding and tentative acceptance of each of these successive steps: Occlusion, office treatment preceding surgical correction, the operation when indicated, and the postoperative training period.

Postoperative training is of importance and should be started early when the angle of squint is "pliable" and the essence of anomalous correspondences can be rocked in their very foundations. The degree of binocular hold obtained previous to surgery is now invaluable to place the residual angle within the controllable range. This opportunity is lost if anomalous correspondences are still too solid or the macula-corresponding area of suppression is too strong.

Reference has been made to the advisability of surgical undercorrection in heterotropias with anomalous correspondences, leaving, so to speak, bridges behind to facilitate retreat if the latter became necessary.

I have chosen, however, a more daring course. Overcorrected cases have done well, as often their severe diplopia was on a sudden normal sensorial relationship, and the secondary surgical correction did not disturb the recently acquired functional success. This is especially true in harmonious anomalous correspondences.

Daring, however, would not have been displayed, had I not relied on my orthoptic assistant to whom should go the greater share of gratitude. Without orthoptic facilities no one should accept the responsibility of the care of an heterotropia with anomalous correspondences.

I wish to thank Miss Enos for the privilege of reading and discussing her fine article, and in concluding take the liberty of quoting Chavasse:[5] "Only through the adequate knowledge of the development and pathology of binocular reactions can the diagnosis of a case of squint become a less unworthy offering, and the treatment a more reasonable prayer upon the altar of truth and before the throne of nature."

1826 State Street.

References

1. Burian, H. M.: Sensorial retinal relationship in concomitant strabismus. Arch. Ophth., **37**:336-648, 1947.
2. Swan, K. C.: Definition of anomalous correspondence. Am. J. Ophth., **28**:58-61, 1945.
3. Kramer, M. E.: Clinical Orthoptics. St. Louis, Mosby, 1949.
4. Mayou, S.: Personal communication.
5. Chavasse, F. B.: Worth's Squint. Philadelphia, Blakiston, 1939, ed. 7, p. 424.

Ophthalmic Miniature

Sophie Javal, a younger sister of Louis Emile Javal, was the first person in the world to receive orthoptic training. When she was two years old, Sichel advised alternate occlusion. At the age of 16 years von Graefe performed a tenotomy; Javal then began to train her fusion with complete success. When Javal first explained his method to von Graefe, who was justly celebrated for his kindness, the latter declared that these people were not worth so much trouble. Experience taught Javal that von Graefe was right. Time and patience beyond all reason were required.

NOTES, CASES, INSTRUMENTS

REFRACTION CLINIC*

DISCUSSION BY ALBERT E. SLOANE, M.D.†
Boston, Massachusetts

This patient is a woman, aged 46 years, who complains of occasional blurring of fine print after prolonged reading, and particularly at night or when she is tired. The glasses she now has were prescribed two years ago for near use, but she now finds that she wears them for the greater part of the day, and that while her naked vision is not impaired for distance, she has the feeling that at times she sees more distinctly with these reading glasses before her:

Refraction wearing: +1.25D. sph., O.U.
20/30 +1.25 20/15
20/30 +1.25 20/15
Add. +1.25 Wells #1 Type

Phoria test at distance:
Distance glass
8$^{\Delta}$ Exophoria
0.5$^{\Delta}$ R. hyperphoria

Phoria test at near:
Near glass
14$^{\Delta}$ Exophoria
0.5$^{\Delta}$ R. hyperphoria

With distance glass:
12$^{\Delta}$ Exophoria
0.5$^{\Delta}$ R. hyperphoria

P. P. convergence = 60 mm.
Positive fusional (prism) convergence
= 18$^{\Delta}$ Base-out
Negative fusional (prism) convergence
= 8$^{\Delta}$ Base-in

The examination revealed the same amount of hyperopia for distance as indicated by the glasses she had worn. With these glasses, she could read fine type but, after a few moments, the print would blur out, and she would have a tendency to push the print farther from her eyes. With an addition of +1.25D. sph. she would not have difficulty in reading small, Bible-size, print, and she noticed that the vision did not blur even after she read for some five minutes. It was also noted, however, that when she wore the reading glasses, she complained of a pulling sensation between her eyes, which was relieved by narrowing the pupillary distance of the frame.

Tests for muscle balance were made for distance while she was wearing the distant correction and this showed the presence of eight prism diopters exophoria. The near-vision test made with the same glasses in place showed 12 prism diopters of exophoria and, when the reading addition was placed before her, the near exophoria increased to 14 prism diopters.

The near point of convergence measured objectively was 60 mm., and the patient could overcome up to 18 prism diopters base-out and maintain single vision for distance. Her abduction, as measured with prisms, was eight prism diopters base-in.

The problem that presents itself here is that we have a situation where a person obviously is in need of stronger glasses to correct her early presbyopia; yet, the introduction of this additional "plus" increases her exophoria to a point where it is symptom producing. This is suggested by the fact that she required the narrowing of her pupillary distance, which induced a base-in effect through decentering her lenses to have her read comfortably during the test.

The near point of convergence is quite within normal limits, and the positive fusional convergence of 18 prism diopters is indicative of a fairly substantial amount available for the compensation of her exophoria. Thus, one would feel that the role of the exophoria may not be as great as it would otherwise appear. Certainly, the blurring of her near vision is to a larger degree explained by the need for more plus power in her lenses.

A good rule to go by is to ignore the

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† Director of Department of Refraction.

muscle imbalance in all borderline cases of heterophoria, if the symptoms may be explained by the need of a change in glasses. In most cases, symptoms will be relieved rather than induced. Guided by this rule, I should, therefore, prescribe for her near glasses giving the weakest amount of plus addition that would enable her to see clearly at the near distance.

I should then recheck her again after a suitable period of time has elapsed (for example, six months), when I would reëvaluate the entire case. If my findings at that time were the same and the symptoms were gone, I should follow along on the same pattern and increase the plus a bit more.

On the other hand, if it becomes evident that the exophoria is playing a significant role, then I should incorporate weak, base-in prisms, in addition to the near correction. If bifocals are to be prescribed, one can then more accurately predict whether or not they will be tolerated. One likes to avoid the introduction of prisms into the near segment.

Frequently, an exophoria seems to be increased by the introduction of a plus lens, and then after that glass is worn for some time, the induced portion of the exophoria no longer exists to as high a degree.

The fact that the patient was relieved during the examination by the narrowing of the interpupillary distance of the frame does suggest that the exophoria is significant, but one must not too quickly evaluate this one finding since it is not infrequent for a person, during a test in which each eye has been examined separately and then both eyes allowed to look at the letters simultaneously, to develop symptoms. The patient's vision is confused and then, after a moment, he volunteers that "now everything has steadied."

Similarly, the narrowing of the trial frame may help to steady the vision. After a while, the frame could be gradually widened again without the patient being aware that this has been done, since no symptoms are introduced. Thus, I should allow this patient to keep her old glasses for distance and would prescribe single-vision near glasses of perhaps plus 0.75D. or even plus 1.0D. addition, and ask the patient to return again in six months, unless there was no relief of symptoms in which case the patient would return at a sooner day.

I should mention at this point that there are those who would suggest that orthoptics would be of aid in helping such a patient, not so much to increase the convergence ability, as to widening the amplitude of fusion. With the presence of 8$^{\Delta}$ exophoria, one would expect a much greater negative fusional convergence reading. One would expect at least as much base-in as the exophoria and an additional amount of base-in prism from the fusional amplitude. In this case, one would suspect that the fusional amplitude was not very wide.

One must not forget that, if you prescribe nothing more than the near glasses, the patients will give themselves orthoptic treatment by simply reading. The stimulus necessary to maintain singular binocular vision in the presence of this fairly substantial amount of exophoria would tend to improve the amplitude.

Question: (House officer). How do you increase the amplitude?

Answer: (Dr. Sloane). Any standard procedures in orthoptics.

Question: (House Officer). Is there any undesirable feature to prescribing base-in prisms at once in the near glass?

Answer: (Dr. Sloane). No question that if, for example, a total of four prism diopters, base-in were incorporated in the near glass and divided between two eyes, the patient would like his glasses, but once the prisms have been prescribed it is not easy ever to take them away from the patient, and prisms offer certain technical difficulties in the bifocal area. Once you prescribe the prisms, the chances are that the person is going to wear prisms the rest of his life.

Question: (House Officer). Supposing the

patient would only require a near glass, would you still hesitate to prescribe prisms after the first year for glasses?

Answer: (Dr. Sloane). I think the same objection still holds true. If the symptoms can be eliminated with the convex lenses alone, the prisms should not be incorporated in the prescription.

243 Charles Street (14).

ADAPTATIONS OF LUNEBERG'S DESIGN*

For demonstrating the geometry of visual space

Marion R. Stoll, Ph.D.
Charlotte, North Carolina

When the mathematician Luneberg investigated the spatial illusions developed by Ames and his colleagues at the Dartmouth Eye Institute, he was led to the conclusion that the geometry of visual space is non-Euclidean and is, in fact, hyperbolic.† The beautiful development and cogency of his argument can be appreciated even by readers who must take the mathematics on faith, as I have had to do.

As a demonstration of his conclusions, Luneberg described a configuration drawn in red and green, and designed to be viewed through red-green spectacles. From points on a Veith-Müller circle, lines are drawn toward the two eyes, those toward one eye in red, those toward the other in green. Viewed through red-green spectacles placed so that the lines directed toward each eye are visible only to that eye, the design gives the impression of a cone with its apex approximately at the feet of the observer and with lines converging down from the rim to the apex.

In the form described by Luneberg, the design is somewhat cumbersome, and it is not feasible for use with children, whose interpupillary distances are usually less than the adult average, and who are reluctant to approach the design closely and to maintain the required position. To avoid these difficulties I tried such portions of a configuration as could be presented on an ordinary

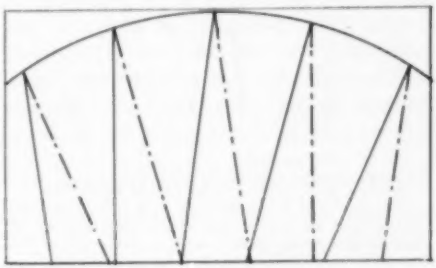

Fig. 1 (Stoll). Solid lines directed toward the left eye are drawn in red, broken lines in green. When the card is held approximately horizontal and about eight inches from the eyes and viewed through red-green spectacles with the red lens over the right eye, the lines appear approximately vertical when fused.

3 by 5-inch card designed to be held so that the more distant edge was about eight inches from the observer (fig. 1). That is, lines were drawn from an arc of a circle of a little more than four-inches' radius and directed toward points about six centimeters apart on the opposite side of the circle. Red lines, directed toward the left eye, were drawn with an Eagle Prismacolor pencil, scarlet lake No. 923; those toward the right with an emerald green No. 910.

The red lines were not visible through the red lens, but even when the green lines were lightly drawn they remained slightly visible through the green lens of the American Optical Company red-green spectacles. This was not entirely satisfactory but was apparently the best result obtainable with locally available materials. The three-dimensional effect was usually appreciated in spite of this.

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† Luneberg, R. K.: Mathematical Analysis of Binocular Vision. Princeton, Princeton University Press, 1947.

With a red glass before the right eye and a green before the left, the lines were usually quickly fused, yielding an impression that they extended down from the arc in an approximately vertical position. This was noted even when the position of the card was varied both with respect to distance from the observer and inclination from the horizontal. For purposes of demonstration this is advantageous and convenient.

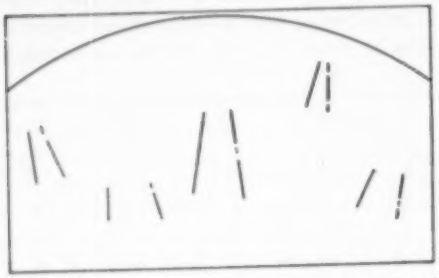

Fig. 2 (Stoll). Drawn in red and green and viewed like Figure 1, the fused lines appear dependent below the card.

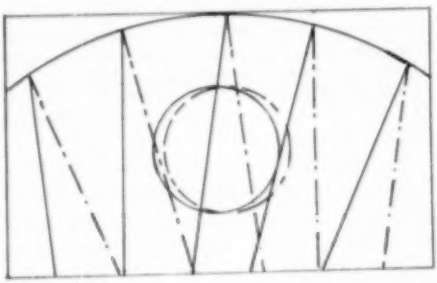

Fig. 3 (Stoll). Drawn in red and green and viewed like Figure 1, the circle appears to lie in an approximately horizontal plane below the arc and below the plane of the paper.

Several children have appeared to give satisfactory evidence that they perceived the depth impression here at least as readily as when ordinary red-green stereoscopic configurations were presented. The youngest, a three-year-old, when asked "How do the lines go?" hesitated for a moment, looking baffled, then turned to the desk and put his fingertips on the surface with his hand dependent from the wrist, saying, "This way." More usually children require some help in finding a way to describe their impressions.

Modifications of the design such as in Figure 2 and Figure 3, demonstrate that even less of the total configuration suffices to produce fusion with the third-dimensional impression, and that details drawn in the usual steroscopic fashion can be added and fused simultaneously with those of the hyperbolic design.

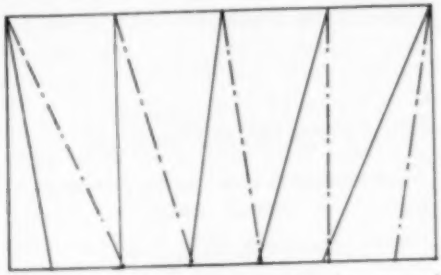

Fig. 4 (Stoll). Drawn in red and green and viewed like Figure 1, the lines fuse to suggest a three-dimensional solid with triangular end surfaces. The lines appear to be on the farther surface.

Additional modifications of these designs are readily made. One in which the lines originate at points on the straight edge of the card seems to yield an especially ready depth impression for adults, but children have appeared to have less success with it (fig. 4).

An attempt to determine the apparent location of additional details (dots added in red and green) has yielded no consistent results although at times it appears that those seen by one eye are more frequently projected to the plane determined binocularly, as Luneberg semed to suggest.

These cards occasionally add something to our understanding of an individual's binocular functioning; they always provide an interesting variant to the usual tests for stereoscopic perception.

106 West 7th Street (2).

EPIDEMIC HERPES ZOSTER OPHTHALMICUS

Report of a case treated with aureomycin

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and
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The following is a case report of epidemic Herpes zoster ophthalmicus in which aureomycin was administered with seemingly beneficial results. Since no drug specific against the action of the offending virus has yet been found and because aureomycin is known to possess definite antiviral properties, it was decided to try this form of therapy in this case.

The aureomycin was administered orally in 250-mg. capsules every three hours, was started on the seventh day of the disease, and was continued for nine days. Because the focus of activity of the virus is in the gasserian ganglion, topical applications of aureomycin borate were not administered. There was such striking improvement in the patient's symptoms within 24 hours of administration of the drug that it is felt the aureomycin was a factor in the subsequent benign course of the disease.

We fully realize that one case proves nothing. However, this case presentation may stimulate a more widespread clinical trial of aureomycin (especially in the larger eye clinics where a greater number of these cases are seen), so that a proper and statistically significant evaluation of the effectivity of aureomycin against the virus of epidemic herpes zoster ophthalmicus may eventually be established.

Braley and Sanders,[1] in their report on the use of aureomycin in a wide variety of ocular infections, list two cases of epidemic herpes zoster as unimproved by this form of therapy. These cases were treated by combined intramuscular and local therapy. However, they suggest further clinical trial of this drug.

Finland, Collins, Gocke, and Wells[2] state, on the basis of unpublished observations, that oral aureomycin therapy has proved particularly useful in cases of Herpes zoster with ophthalmic distribution of the lesions. They caution against premature discontinuation of the drug.

Case report

History. C. C., a 59-year-old white man, was first seen on August 8, 1949, with a history of pain across the top of his head which started five days previously. Two days after the onset of the pain, an eruption appeared over the right side of the forehead. At this time, the pain disappeared.

Examination revealed a well-developed and well-nourished white man who appeared lethargic. His temperature was 102.5° F. The right side of the forehead was covered with typical herpetic lesions which extended to the midline and into the hairline. There were lesions on the upper lid and three lesions on the right side of the nose, one of which was at the side of the tip of the nose. The upper and lower lids were edematous and almost completely shut.

The uncorrected visual acuity was: O.D., 20/25; O.S., 20/25 + 3. The palpebral and bulbar conjunctiva, O.D., were injected. The right pupil was smaller than the left with normal reaction to light, directly and consensually. The extraocular movements were normal.

Slitlamp examination of the right eye revealed small fluorescein staining areas of desquamated corneal epithelium scattered over the entire cornea. Beneath most of these there was infiltration of the superficial layers of the corneal stroma. There was one intact epithelial vesicle. There were no keratic precipitates, aqueous flare, or cells. Both lenses showed early anterior and posterior cortical opacities.

Ophthalmoscopic examination. There were no vitreous opacities. The discs and maculas were normal. The vessels revealed early sclerotic changes which were considered nor-

mal for a person of this age. There were no hemorrhages, exudates, or retinal edema.

Course and treatment. The right eye was atropinized and a bland ointment was instilled. Thiamine chloride, (5 mg., three times daily), ascorbic acid, (50 mg., three times daily), vitamin-B complex and mineral oil, (two drops in the right eye every two hours) were prescribed. The patient was vaccinated against smallpox (this did not "take").

On the following day, the patient was more lethargic and the eyelids were swollen shut. On the third day of observation, the temperature was 102.5° F. He was prostrate in bed, slept practically all of the time, and, when he was not sleeping, he was irrational and suffered from delusions. There was no grossly visible staining of the cornea.

Aureomycin, in oral dosage of 250 mg. every three hours, was started. On the following day, the patient did not appear ill, was no longer irrational, was up out of bed, and stated that he "felt like a new man." His temperature was 100.5° F. Forty-eight hours after the administration of the aureomycin, the temperature was 99.1° F. In 72 hours, the temperature was 98.4° F. and remained at that level.

The patient stayed at home during this period and slitlamp examination was not performed for five days. On August 13th, another smallpox vaccination was performed in order to check whether the first vaccination was really a "no take," or whether perhaps, an immune reaction did occur and possibly was missed. This time, a typical primary reaction was observed and this was accepted as ample proof that the first vaccination did not "take."

On August 16th, no corneal staining was visible with the slitlamp. The patient made a gradual and progressive improvement. On one occasion, three small keratic precipitates suddenly appeared nasal to the center of the cornea. Upon increasing the atropine (one percent) to daily instillations, these rapidly disappeared. There were three corneal opacities, one of which (0.5 mm. in diameter) was grossly visible. The patient returned to work on September 11th.

Summary

A case of epidemic herpes zoster ophthalmicus treated with oral aureomycin has been presented. The marked improvement in constitutional symptoms within 24 hours of administration of the drug is suggestive of therapeutic activity against the offending virus.

585 Main Avenue.
271 Lexington Avenue.

References

1. Braley, A. E., and Sanders, M.: Aureomycin in ocular infections. Am. J. Ophth., 32:119 (June, Part II), 1949.
2. Finland, M., Collins, H. S., Gocke, T. M., and Wells, E. B.: Present status of aureomycin therapy. Ann. Int. Med., 31:39, 1949.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

December 15, 1949

DR. PERCE DELONG, *chairman*

THYROTROPIC EXOPHTHALMOS AND PSEUDOTUMOR

DR. EDMUND B. SPAETH AND DR. HOWARD BEDROSSIAN (by invitation) reviewed the literature and discussed Means' theory of the mechanism of thyrotropic exophthalmos. Mulvany's theory of a different mechanism producing thyrotoxic and thyrotropic exophthalmos was next discussed and pathologic evidence supporting this theory was presented. A clinical and pathologic comparison was made between thyrotoxic and thyrotropic exophthalmos. An interesting case of thyrotropic exophthalmos with a pathologic report was presented.

Discussion. Dr. Robert Groff: A very excellent review of the subject of thyrotropic exophthalmos and the various conditions which might be mistaken for it has been presented. My remarks will be directed toward the procedure of decompression of the orbit.

In this particular patient the right eye was explored through an extracranial approach. Because the exposure was inadequate, a misinterpretation of tumor tissue was made and for this reason X-ray therapy was given. Because of the intensity of the X-ray therapy, the eye became blind and had to be removed. If the orbital contents had been explored by means of an intracranial approach, I am sure this mistake would not have been made, X-ray therapy would not have been given, and the eye, in all probability, would have been saved.

There are three distinct advantages to an intracranial exploration of the orbital contents for exophthalmos. The first of these is that it permits an exploration of the sphenoid ridge. This is extremely important because the inner side of the sphenoid ridge, is a common site for the development of meningioma. This tumor is a common cause for unilateral exophthalmos, but invariably it is associated with a thickening of the bone which can be demonstrated in the X-ray films.

The second advantage is that, after the roof of the orbit has been removed, the orbital contents can be clearly seen and, therefore, carefully examined. Thus one can determine whether there is a tumor present or whether the pathologic processes are diffuse, involving all of the contents of the orbit.

The third advantage is that, if a tumor is not found on the sphenoid ridge and no pathologic condition is found in the orbit itself, an exploration for an aneurysm of the internal carotid artery can be made. It can be seen, therefore, that the intracranial exploration of the orbit can rule out three types of pathologic processes, two of which are not within the orbit itself.

In the patient under discussion, two things were unusual. In the first place, the roof of the orbit was extremely thick, necessitating a hammer and chisel in order to obtain an opening so that the bone could be removed. Because of this factor, it is quite apparent that an attempt to explore the orbit through a lateral approach would have been almost impossible.

The second unusual thing was that, on elevating the bone flap, the dura was so densely adherent to the bone that it was torn. Ordinarily the dura would not have been opened, the entire procedure being done extradurally, but in this instance we were within the intracranial cavity before we intended to be. It presented no particular problem, but I am sure it was responsible for the man's period

of aphasia following operation, because more traction had to be made upon the frontal lobe than would have been made if the dura had remained intact.

It is important when operating upon the dominant hemisphere that the patient be informed before operation that there is a possibility of his becoming aphasic. By so informing the patient you prevent the anxiety which occurs following the operation when the patient learns that he cannot talk.

The intracranial decompression of the orbit should be looked upon as the ideal approach for intraorbital lesions. The procedure is simple, is not attended with particular shock, and takes only a matter of one to two hours to perform. I recommend it to you enthusiastically.

Dr. Edmund B. Spaeth: This is one of those cases concerning which it is easy to be critical and difficult to be restrained. The first fault was that a diagnosis of an orbital tumor was made and X-ray therapy was given before any attempt to confirm that diagnosis was made. One cannot make a diagnosis of an orbital tumor which might respond to X-ray therapy by X-ray examination alone.

After the development of the exophthalmos in the left eye, the slides of the orbital tissue from the right eye were sent to various pathologists for reëxamination. Pseudotumor had been the original diagnosis. At the time, too little attention was paid to microscopic examinations of the muscles found in sections from the orbitotomy. This was the second error.

The third mistake was the reconsideration of possible intracranial aneurysm. This case demonstrates beautifully one of Walsh's subdivisions in his classification for aneurysms with complete external ophthalmoplegia. It was for this reason that the arteriogram was done. Even at that, the correct or most probable diagnosis was not made by the pathologist but by one of the neurologists.

Dr. C. E. G. Shannon: Three years ago I had the privilege of presenting before the Eye Section of the Pennsylvania State Medical Society five cases of exophthalmos of thyro-pituitary origin. Four of these cases were admitted to Jefferson Hospital with a diagnosis of thyrotoxicosis. Operation was advised and was carried out successfully. Unfortunately ocular palsies had developed and, at that time, I took particular interest in that phase of the subject.

About a year following the operation, I carried out procedures for these muscular palsies, and I am happy to report that the results were gratifying. In two of the cases, I succeeded in obtaining binocular single vision. In the third case, which was seen by Dr. Zentmayer, following the muscle operation the eyeball surprisingly returned to its normal position—a development for which I can offer no explanation.

Tonight, I am particularly interested in the fifth case—malignant exophthalmos—and I would like to read a brief history of this case.

A man, aged 46 years, a mechanic, suffered from nervousness, weight loss, excessive sweating, and marked exophthalmos when seen in August, 1943. He was admitted to Pennsylvania Hospital in October with all the features of thyrotoxicosis, and with a basal metabolic rate of +126.

On October 22nd, an almost total thyroidectomy was performed revealing a diffuse toxic hyperplasia of the gland. However, the exophthalmos and nervousness gradually increased and, on January 1, 1944, there was sudden marked proptosis followed by photophobia, diminished visual acuity, and supraorbital pain.

He was admitted to Jefferson Hospital on January 21, 1944, with a typical malignant exophthalmos, bilateral, and advanced keratitis so that vision was totally lost, temporarily, in the right eye. The basal metabolic rate was −21. On January 22nd, by reason of the great edema, I attempted scarification of the conjunctivas on both sides and applied eye shields as a protective measure. On the 27th the right eyelids were sutured, but this procedure proved ineffective.

On March 9th, Dr. Rudolph Jaeger per-

formed a Naffziger operation on the right side and a Naffziger-Krönlein operation on the left side. Continuous administration of thyroid extract and a moderate course of irradiation to the pituitary were carried out. The patient was discharged May 18, 1944.

I think the point of paramount importance in this case is to determine whether it was a case of thyrotropic or thyrotoxic hyperthyroidism.

Dr. William T. Hunt, Jr.: An interesting test has been devised by Dr. Savino D'Angelo of the Jefferson Hospital staff.

It is known that, when the tadpole of the leopard frog is starved, it remains in the state of stasis for as long as 30 days. Examination shows the thyroid epithelium to be atropic, the gland distended with colloid, and no hind-limb growth. Injecting 0.05 cc. of thyroid-stimulating hormone into the peritoneal cavity causes the hind limbs to grow a certain amount and the thyroid epithelial cells to raise a certain amount. As little as 0.0005 of a Junken-Schuler unit could be told. The ratio of the height of epithelial growth to the length of the growth of the hind legs has been determined when stimulated by thyroid-stimulating hormone. Thyroid hormone (Thyroxin) will cause growth of the hind legs, but it does not raise the height of the thyroid epithelium.

On the basis of these findings, a test has been devised to test the approximate amount of the thyroid hormone and the thyroid-stimulating hormone in the raw blood serum. Standards have been set up.

Sera from pathologic and normal patients have been used. It gives an idea of the abnormal ratio in endocrinopathies.

Observations on retrolental fibroplasia

Dr. William O. La Motte, Jr., and Dr. George S. Tynor (by invitation) reviewed the literature on this subject, with particular reference to the opposing views of a congenital origin versus a postnatal acquired disease. Mention is also made of the evidence in the recent literature against any relationship between the incidence of the disease and such factors as increased survival rate, maternal disease, and infant management and feeding.

Cases were presented from the Delaware Hospital in Wilmington and from the Hospital of the University of Pennsylvania which seem to indicate an increased incidence of the disease in recent years and to confirm the thought that increased survival rate, maternal disease, and infant-feeding factors are of no demonstrable significance.

Those infants examined periodically from birth showed no clinical evidence of the disease at the time of the first examination, and developed the disease according to the pattern first described by Owens. A disease primarily retinal, with vascular engorgement and tortuosity, retinal exudative phenomena, and retinal detachment, constitutes the picture invariably seen.

The first retinal changes were observed as early as 23 days, and the latest that the first retinal changes were seen was 45 days. No infant which was ophthalmoscopically normal on discharge from the hospital has subsequently developed the disease. During 1949, the disease developed in 9 out of 18 infants weighing under four pounds at birth, and the incidence has been just as great in the 3 to 4 pounds group as in the infants under three pounds at birth.

Two infants were observed whose eyes were normal at the time of the first examination except for extreme threadlike attenuation of all the retinal vessels. These subsequently assumed normal caliber, and then developed the marked vascular and exudative picture described as typical of this disease.

The results of the use of alpha tocopherol acetate prophylactically and therapeutically are recorded. Two cases, which had developed the marked vascular stage of the disease, returned to normal while on vitamin E. This is considered of possible significance because prior to the use of vitamin E no case in which this vascular picture developed reverted to normal.

In a control group of 11 infants weighing between 3 and 5 pounds at birth, only one developed the disease, and then only the marked vascular stage without exudate or detachment. These changes were arrested and the eyes reverted to normal while the patient was on vitamin E, started at age of 26 days.

In a similar group of 17 infants, who were on vitamin E from shortly after birth, three have developed the disease in its severest form bilaterally despite the laboratory finding of adequate serum-E levels in all three cases.

The failure of prophylactic vitamin E from shortly after birth to prevent the development of the disease is emphasized. The possibility that this vitamin supplement might even be harmful is suggested.

Dr. George S. Tynor: The eyes of all infants in the premature nursery of the Hospital of the University of Pennsylvania are being examined as soon after birth as conditions permit. Those with birth weights of four pounds (1,810 gm.) or less, are examined at weekly intervals while in the nursery. Those with birth weights over four pounds are examined less frequently.

During the past five months, 42 premature infants have been observed. Ten weighed less than four pounds (1,810 gm.) at birth. The disease was found in two of these 10 infants. Both cases are in males. Both are twins with a normal female sibling. Neither case has any other significant abnormality. The earliest sign of the disease was present at the time of the initial examination.

Case 1. J. F., birth weight 1,795 gm., was first examined 15 days after birth. At this time he showed markedly dilated and tortuous retinal veins and arteries in both eyes, the right eye be[illegible]ore affected. In addition, the right [illegible] remnants of a persistent anter[illegible] membrane. There was gradual progression in the size and tortuosity of the vessels during the next two weeks, after which time no significant change was observed for one month. If anything, there was a slight improvement in the appearance of the fundi. Following this quiescent period, bilateral retinal detachments were noted in the periphery, the right eye being the most affected. The right disc appeared blurred in outline and partially obscured by what might be newly formed fibrous tissue. The detached retina resembled a retinitis proliferans with fibrous bands extending forward into the vitreous. There was vascular proliferation on the surface of the retina. No hemorrhage was noted at any examination.

This child has received 150 mg. of water-miscible vitamin E daily since the third week of life. The vitamin-E blood level, determined by Dr. Paul Goldhaber of Harvard Medical School, was 4.74 mg. percent (normal value is 0.2 mg. percent).

Case 2. M. H., birth weight three pounds (1,350 gm.), was first examined 52 days after birth. At this time the eyes were normal except for a single dilated retinal vein in the left eye. Over a period of one month following the initial examination, progressive enlargement and tortuosity of the retinal vessels was observed. This change became bilateral and involved all the retinal vessels.

Two months after the initial examination, bilateral symmetrical changes were noted on the discs extending temporally. The appearance of these changes most resembled the condition referred to as congenital retinal septa or folds.

This child has also been on high doses of vitamin E since the progressive vascular changes were first noted. The preparation used in this case was an oily form of vitamin E. The blood level was found to be 0.57 mg. percent and, although within normal range, was only about a tenth of that found in the child receiving the water-miscible preparation. As soon as this lower level was noted, the child was also placed on the water-miscible preparation.

Our number of prematures examined periodically from birth is too small to draw any conclusions. It seems apparent, however,

that early and frequent examinations must be made on all prematures of four pounds and less. As pointed out by Dr. LaMotte, the disease process occurs with increased frequency in the children with birth weights near the four-pound level as well as in the extremely small infants. The disease process has been noted much earlier than the present literature indicates. We are also impressed by the fact that the disease process has shown progression despite early administration of vitamin E.

Dr. I. S. Tassman: I think both speakers have had an excellent opportunity in the study of these cases to clear up several points that until the present time have been in dispute. I would like to ask whether they have seen any cases which resembled those which are described by Reese, and which might be considered as persistent primary vitreous?

It seems that most of the cases presented belong to the category of retrolental fibroplasia, as described by Owens and Owens, and yet there is a great similarity between these two conditions. Reese, however, recently stated there are two separate conditions: the one retrolental fibroplasia and the other persistent primary vitreous.

The difference appears to be not so much in the appearance of the condition, but rather in its origin or etiology; that is, in retrolental fibroplasia, it appears that the detachment of the retina or edema of the retina, following the changes in the vessels that were described, initiates the condition. In other words, retrolental fibroplasia begins posteriorly in the retina with changes in the retinal vessels; then edema and detachment, cloudy vitreous, and then band formation extending forward through the vitreous until the entire posterior lens is covered.

In the other, it appears that the condition is initiated by a persistent primary vitreous and failure of the secondary vitreous to develop. In other words, it is an interference with the development and a regression, leading to fibrous bandlike formation, and from this source the proliferation extends posteriorly toward the retina, and the detachment of the retina is secondary.

Hemorrhages occur in both conditions but, in the persistent primary vitreous, there is also supposed to be the remnants of hyaloid artery and tunica vasculosa lentis which are not seen in retrolental fibroplasia.

Were any cases at all encountered which represented the condition described or which might be considered to be a persistent primary vitreous? Of course, the diagnosis of the latter condition was made by Reese after pathologic examination. The diagnosis of retrolental fibroplasia is usually a clinical diagnosis.

Another question I would like to ask with regard to these cases that were treated with alpha tocopherol acetate, or with vitamin E in any form: Were any other vitamins given at the same time, or were they on vitamin E exclusively? Was vitamin A eliminated entirely from the diet of all of these infants? Owens and Owens felt that these patients were possibly deprived of vitamin E because of the excessive feeding of vitamin A, since they were premature infants, and, since vitamin A will destroy or inhibit the levels of vitamin E, they concluded there might be a deficiency of vitamin E in these cases. It would, therefore, be interesting to know whether or not vitamin A was given or whether it was also included in the diet or in the feeding of these infants.

I think the authors should be congratulated. I believe that their surveys of this condition were very interesting, but certain aspects still remain rather puzzling.

Dr. M. Luther Kauffman: I have had the opportunity of seeing at one place or another some 18 of these patients equally divided between males and females.

It is quite obvious to me that the pattern isn't always exactly the same. Several times I have been impressed by the retinal separation in the periphery appearing without much vascular change, and strangely my general impression is that, in those cases showing partial involvement, the temporal fundus has

been more often affected than the nasal fundus. Several cases have developed folds running from the disc temporally. It is also quite obvious from this observation that some of our nomenclature of fundus findings will probably have to be revised. The congenital folds that have been observed in the past may possibly have to be brought into this category.

Most of the patients whom I have seen have been in an early period of life, have weighed under three pounds, and have had, almost without exception, a fetal type of vitreous. By that we mean that the vitreous in this condition resembles the vitreous of high myopia. It is a little difficult to get through to the fundus. In some of the cases in which the vitreous has cleared, retrolental fibroplasia has developed later. Some of the patients I have seen appeared quite all right when they weighed over five pounds and were ready to leave the hospital, but later they developed the condition.

I am in entire agreement that retrolental fibroplasia can occur in some of those who weigh over three pounds and nearly four, as well as in those under three pounds. In one patient whom I have observed, the disease has been confined entirely to one eye. That patient is now very nearly eight months old.

Dr. William O. La Motte, Jr.: Dr. Tassman has asked about the cases described in the literature as persistence of the primary vitreous, and whether any of the cases reported here might not fall in that category.

As far as I know, there has been no one who has observed such lesions develop from the vitreous, since such a condition is supposed to be present at birth. The only cases which have been seen to develop from eyes apparently normal at birth have followed variations of the pattern described by Owens and Owens. Reese has stated that the great numbers of cases we have been seeing with increasing frequency are true retrolental fibroplasia, while the entity based on persistence of the primary vitreous is relatively rare.

Dr. Tassman inquired about the use of other vitamins in conjunction with vitamin E. Since early reports seemed to point to water-soluble vitamin A as a factor in this disease, this vitamin has been withheld in water-soluble form, but supplied in oily form such as oleum percomorphum, which of course also supplies vitamin D. Ascorbic acid has been the only other supplement. I have not dwelled upon the interrelationships of these vitamins, because of the opportunity we will have next month to hear Dr. Kinsey discuss this very subject.

I certainly agree with Dr. Kauffman that we have only begun to explore all the different varieties and ramifications of this disease, and the sometimes conflicting observations of different individuals only stimulate us to more precise efforts.

Reduction in vision due to sunlight

R. H. Peckham, Ph.D. (by invitation) and Dr. R. D. Harley (by invitation) discussed reduction in visual acuity due to excessive sunlight.

The dark adaptation of the retina occurs when the eye is in darkness, or when the level of illumination is very low, as at night. There is also a converse adaptation phenomenon, of light adaptation, when the level of the illumination is bright, as during the day or under artificial illumination. The effect of excessive exposure to sunlight has been shown by Hecht to amount to about 0.2 log units, or to require an increase in absolute threshold, in dark adaptation, of about 150 percent. Clark has confirmed this finding, working also at the extreme level of dark adaptation, and he also showed that 12-percent sun glasses served to protect the retina against this loss of sensitivity.

These observations raise the two questions: Is there a loss of retinal sensitivity that is effective in reducing photopic vision? and: If there is such an effect, can it be prevented?

Such an effect, in photopic vision, would be expected in the perception of low contrast objects in dim photopic illumination, of about 1.0 to 0.10 foot-Lamberts, and could be

measured as a reduction of visual acuity at these levels. Blackwell has published measurements of normal visual acuity at low contrast and dim illumination. This visual acuity under such conditions was measured on 70 life guards of the Atlantic City Beach Patrol during the summer of 1948. It was found that a gradual decrease of visual acuity occurred during the course of the summer. It was also found that the observations were very difficult to make, and that large individual differences were found.

It has been pointed out that the critical fusion frequency for a flickering light depends upon the brightness of the light (Hecht and Wolf). It was reasoned, conversely, that if the brightness of the light is kept constant, individual differences in critical fusion frequency represents the effectiveness of the light on the retina, in other words, retinal sensitivity.

The critical fusion frequency of a flickering light was determined at various times during the sumer of 1949 on a second group of life guards at Atlantic City. The measurements were made in the morning and evening of the first three days of beach-patrol duty on these men, morning and evening at the end of a week, and morning and evening at the end of two months.

The 30 life guards were divided into three groups. One group was provided with dark-glass goggles of 10 to 15-percent transmission. One group provided themselves with commercial goggles of 35 to 50-percent transmission, and one group preferred to wear no sunglasses.

The group with special dark sunglasses showed less loss from morning to night than the other two groups, and better recovery from night to morning. The other two groups showed consistent loss of retinal sensitivity, as shown by critical fusion frequency of flicker, amounting to an average of near 0.2 log units (37 percent reduction of sensitivity), with individual records not infrequently amounting to 1.0 log units (90 percent loss) on various days. This group also showed greater inability to recover retinal sensitivity during the night than those with special dark sunglasses. These values correspond to the losses in visual acuity at low contrast found the summer before, and to the loss of threshold sensitivity reported earlier by Hecht and Clark.

This loss of sensitivity can be interpreted as a reduction of effective illumination, or as a reduction of visual acuity for low contrast objects. (The reduction also occurs for high contrast objects in bright light, but is less noticeable.) For example, the light from a 60-watt bulb would be only as effective to an exposed subject as that from a 40-watt bulb to a normal person. The effect can be also predicted for the condition of driving an automobile, and may be an important contributory cause for traffic accidents.

The loss can be prevented by wearing very dark sunglasses, of about 10 to 15-percent transmission, as shown by our own experiments and those of Clark. The loss cannot be prevented by wearing commercially produced sunglasses of 35 to 50 percent transmission. Since Clark's sunglasses transmitted infrared and ultraviolet rays to a considerable degree, and since the commercial sunglasses of 35 to 50 percent absorbed these rays, it is obvious that the loss is caused by the excessive visual brightness of the sunlight.

Recent published work by several investigators has shown conclusively that the rate of dark adaptation is altered to a large extent by the intensity of the brightness to which the eyes have been previously exposed. It is also known that adaptation to light of high intensity not only delays the onset of rod adaptation but also delays the final dark-adapted threshold. Independent studies begun four years ago by one of us (R. P.) substantiate these results.

Having been stimulated by these observations, our attention next turned to the consideration of the effects of sunlight on the normal eye of individuals light-adapted to ordinary intensities. Information available was inadequate to answer our precise question for we reasoned that there should be a

corresponding loss in cone vision comparable to that found for rod vision.

In our experiments the aim was to determine the loss of retinal sensitivity (cone portion) in the light-adapted eye, and to the exclusion of scotopic vision so far as possible.

In the event that a loss of sensitivity was encountered, we proposed to evaluate the effects of low transmission glasses as an inhibiting mechanism. The methods employed for this determination consisted of the use of contrast discrimination at low photopic brightness levels the first summer and measurements by the flicker apparatus the following summer.

Our findings indicated that loss of sensitivity in exposed eyes begins in 3 to 5 hours, and is cumulative over a period of seven days. In many subjects recovery took place overnight while in others the effects were cumulative for a period of a week until no further loss was encountered.

Furthermore, our results show that recovery of retinal sensitivity is likely, and that the total effects are not permanent. It is to be emphasized that we were not concerned with the effects of direct exposure to the sun or the question of eclipse blindness.

Ophthalmologists can make use of this information when prescribing for individuals anticipating exposure to brightness levels to which they are not accustomed, and for which they cannot readily adjust.

The clinical significance of these experiments on the loss of retinal sensitivity as a whole can be appreciated when one considers the effect of reduced visual efficiency for all visual tasks where illumination is critical such as in the daily work or automobile driving under artificial lights.

One might ask what relationship exists between visual acuity and perception of flicker? Visual acuity depends on the ability of the eye to resolve two stimuli separated in space, while flicker perception entails resolution of two stimuli separated by time. The common denominator of both processes is retinal sensitivity, and both functions will be influenced by a change in sensitivity. The flicker instrument appears to be a valuable adjunct for the further study of problems dealing with retinal sensitivity.

In conclusion our investigation shows that loss of retinal sensitivity in the cone portion does occur from the presence of sunlight and glare under average conditions at the beach. Data obtained by the method of low contrast discrimination and flicker fusion frequency were comparable. The results indicate, in effect, a loss of visual efficiency as compared to vision under ordinary lighting conditions.

Discussion. Dr. Alfred Cowan: The results of the kind of work being done by Dr. Peckham and others are of very great importance to ophthalmologists. It would be sufficient if it were only to show the utter uselessness of the slightly tinted glasses. Slightly tinted lenses have just as much effect as the pieces of cellophane you saw pasted on the slide. On the other hand, the results shown in this paper stress how important it is for sunglasses to be dark.

It was found during the last war that dark glasses which transmitted 12 to 15 percent of light were not of very much use in the arctics, in the tropics, or in those places where the light was of extreme intensity. Before the war was over, glasses of transmissibility of only four percent were being used, and it was found that the Germans were using even darker glasses than that.

It can be realized how little help is offered to the persons exposed to high intensities by the ordinary commercial dark glasses that transmit 25 or 30 percent of light, and these are fairly dark glasses, too, as we see them. Imagine, also, the person who has been exposed to extreme sunlight all day and who has lost as much sensitivity as Dr. Peckham has shown, wearing any kind of dark glasses at night or indoors, even though he has been protected all day long with good dark glasses.

M. Luther Kauffman,
Clerk.

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A GOOD, A VERY GOOD MAN

On Sunday morning, July 16, 1950, a service in commemoration of Sir William Bowman was held in St. James' Church, Picadilly, London. A more fitting prelude to the great XVI International Congress of Ophthalmology could not have been conceived. The bomb-shattered shell of this beautiful Wren church lay, peacefully surrounded by its lovely forecourt and garden, glowing in the soft noon brilliance of a midsummer English day. Its destroyed roof and burned-out interior had scarcely been touched since the terrible night of its agony. Indomitable grass and flowering weeds peeped out from under the charred timbers of altar, pews and holy beams and the unyielding hand of man could be discerned in the partial and temporary restoration of the south aisle as promises of resurgence.

The program stated austerely "the part of the church which has been rendered fit for use again, after its destruction by enemy action, will accommodate about 140 people only." Those who could not gain admittance, and there were many, heard the service broadcast into the Baptistry and into the forecourt. The experience was unforgettably moving.

It began with the hymn accompanied by a simple melodeon, "From Thee all skill and science flow; All pity, care and love; All calm and courage, faith and hope—; O, pour them from above!" Then followed the gospel lesson from Mark X, v. 46. Beautifully read by Mr. Frank Laws, the secretary-general of the Congress, it describes the miracle of blind Bartimeus.

Prayers were then offered by the Venerable C. E. Lambert, Archdeacon of Hampstead, Rector of St. James, Picadilly, who was in charge of the service.

An address by Professor Nordenson, president of the International Council of Ophthalmology followed. He said:

"The International Council of Ophthalmology has felt a strong desire to give an outward token of its admiration of Great Britain's large contributions to our science and of the men behind them. It has therefore asked for permission to lay down a wreath to the memory of one of the foremost of them, William Bowman.

"We are assembled here near the epitaph of one of the most remarkable men in modern ophthalmology, a genius of rare universality, a character of rare nobility. After having already, as an undergraduate, made highly valuable discoveries in histology and, after having been an admirable teacher of physiology, he devoted the best years of his manhood to ophthalmology; here his familiarity with the said sciences enabled him to widen considerably our knowledge of the structure and the functions of the eye, and here his open eye and well-balanced judgment brought highly valuable contributions to all branches of ophthalmic surgery. He was an admirable clinician and, according to his great contemporary v. Graefe, one of the most skilful operators of his time, equalled by few, surpassed by none. About his magnanimous personage there grew up a generation of British ophthalmic surgeons, whose works became of fundamental importance to the development of our science.

"When in these days the International Congress of Ophthalmology meets here in London, we recollect how international relations in modern ophthalmology were first established when, nearly a century ago, three leading men, William Bowman, Cornelius Donders, and Albrecht v. Graefe met here in London, in 1851. That meeting left in each of them a profound admiration of the two others, and in close coöperation, these three eminent men then carried through the great reform of ophthalmology.

"In deepest admiration the International Council of Ophthalmology pays homage to William Bowman's noble personality and great achievements."

Sir Stewart Duke-Elder, president of the XVI International Congress of Ophthalmology, continued:

"I can think of no more delightful gesture of sympathetic understanding of the spirit of British ophthalmology than this act of Professor Nordenson's of laying this wreath on behalf of the International Council at the Memorial Plaque of Sir William Bowman. To us in Britain, of course, he was in every sense the founder of our special branch of surgery, just as he was the first president of our ophthalmological society. But renowned as he was throughout the world as a scientist who made immense contributions to our knowledge, respected as a surgeon, a physician, and a teacher unequalled in this country, in time he is remembered still, far beyond the boundaries of this country, for his kindliness, his sincerity, and the warmth of his personality.

"By this graceful act, Professor Nordenson, you and your Council are honouring not only the memory of Sir William Bowman, not only through him, British ophthalmology, but also those traditions of kindliness, integrity, and Christianity which are the proud characteristics of his and our profession. It is strangely moving to stand here in this ruined church where 100 years ago Bowman used to worship, for although the passions of man have destroyed this building, yet your offering makes it clear that the

generosity, the charity, and the gratitude of man still live and are more enduring.

"With these feelings, in the name of British ophthalmology, with pride and in humility, I accept your graceful offering; and I hope you will believe me when I assure you that the memory of today's service will remain long with us."

The service concluded with the hymn, "Thine arm, O Lord, in days of old; Was strong to heal and save; It triumphed o'er disease and death; O'er darkness and the grave; To Thee they went, the blind, the dumb; The palsied and the lame; The leper with his tainted life, The sick with fevered frame."

After the Blessing by Archdeacon Lambert, Professor Nordenson placed a wreath on the Memorial Tablet of Sir William Bowman in the Baptistry, seen in the accompanying photograph, which poignantly reveals part of the ruins of the interior as well.

The Memorial Tablet of Sir William Bowman in the bomb-shattered Baptistry of St. James' Church, Picadilly, London.

The verse on the inscription is from Longfellow's poem "Blind Bartimeus," and was suggested by Alfred, Lord Tennyson, who was a close friend of Sir William Bowman. Longfellow on November 3, 1841, wrote the poem, inspired by reading the Greek verses of St. Mark used in the lesson by Mr. Law. He said, "At once the whole scene presented itself to my mind in lively colors, the walls of Jericho, the cold wind through the gateway, the ragged, blind beggar, his shrill cry, the tumultuous crowd, the serene Christ, the miracle; and these things took the form I have given them above, where perforce, I have retained the striking Greek expressions of entreaty, comfort, and healing. The Voices Three are the beggar's 'Lord, have mercy on me,' the people's 'Be of good comfort, rise, he calleth thee' and Christ's 'Go thy way, thy faith has made thee whole.'"

Bowman's courtesy, his gentleness, his integrity, his loyalty to his friends, his devotion to his patients, his forbearance to his critics, his skill and Christianity have endured to this day. Inventive genius, didactic ability, operative skill, gift of organization, or a combination of all of these qualities endow no man with the power to arouse his fellows to higher efforts to better the condition of fellow men, save that he has Bowman's quality of heart and soul.

Ophthalmologists throughout the world will take pleasure in contributing willingly toward the restoration of St. James' Church, Picadilly. It is suggested that the ophthalmic societies of the United States take the leadership in the establishing of a fund for this purpose, in memory of Sir William Bowman.

Derrick Vail.

FLICKER FUSION IN DIAGNOSIS

The critical or fusion frequency of flicker refers to the minimal number of discrete flashes per second that gives a continuous visual sensation. It measures the persistence of sensation since the critical frequency varies reciprocally with the apparent duration of the latter. The test has been of utmost value to visual physiologists for well over a century but only recently has the technique been adapted for routine clinical investigation.

The appraisal of this method of diagnosis requires that the physiologic factors which affect critical frequency be properly evaluated and, wherever possible, standardized or compensated. The critical rate of flicker is greater for cones than for rods because of more rapid adaptation by the former. In achromatopsia where the cones are assumed to be functionally inactive the critical frequency was 20 compared to 55 in normal individuals. With good illumination the critical frequency is normally greatest in the 10-degree zone due to the summation effected beyond the macula.

Flicker fusion depends on a primitive visual sensation that has no correlation with visual acuity. Though the Maddox rod reduces visual acuity to almost zero it does not affect critical frequency. With apparent central fixation, the eye with suppression amblyopia shows a definitely higher frequency than does the normal companion eye, averaging, according to Miles, 46.5 versus 45.1. This demonstrates that the amblyopic eye actually has eccentric fixation similar to that which normally accompanies the central scotoma of dark adaptation.

For an intensity of 10 foot-candles the critical frequency decreases progressively beyond the 10-degree zone. For most areas it is also lower temporally, probably because the larger vessels on the nasal retina reduce the stimulus. To compensate for these differences, R. Weekers adjusts the target size to secure a uniform frequency throughout a 30-degree field under normal conditions. In the 26 points routinely investigated the variation required is from 3 to 7 degrees. With this technique, Weekers compared the fields of flicker fusion with those of campimetry in several hundred pathologic cases.

Any depression of an isopter has its counterpart in a proportional depression of the critical frequency.

The flicker-fusion test reveals the precise limits of a retinal separation including that which is detached but slightly. After apparent surgical cure it also evaluates most delicately areas of persistent functional deficiency.

In glaucoma, a depression of the flicker-fusion rate occurs early and may be present before perimetry suggests any abnormality; and defects elicited by campimetry may be more completely revealed by this method.

In tobacco amblyopia, the depression of critical frequency is marked even when campimetric signs are slight, the flicker-fusion change being the earliest sign to appear and the last to disappear.

In cataracts, a depression of the fusion frequency beyond that attributable to the lens opacity is indicative of a retinal or neural pathologic condition. A retinal lesion can be distinguished from a retrobulbar lesion, when the question arises, by exciting two neighboring retinal zones simultaneously, as only the retinal lesion will interfere with the process of summation.

In neuro-ophthalmology, flicker perimetry has proved most valuable. An enlarged blindspot is easily detected. Phillips found a diagnostic decrease in critical frequency in two cases of parietal lobe tumors in which normal visual acuity and fields were present. Riddell demonstrated a total hemianopia where standard perimetry had indicated only a temporal slant; Weekers, a complete hemianopia where campimetry revealed but a quadrant defect. Miles recently reported his findings with flicker fusion in tumor of the optic nerve, pituitary adenoma, and multiple sclerosis.

European investigators still produce flicker fusion with some form of the rotating sectored disc, but this traditional method has been superseded in America by the electronically controlled gas-discharge tube. This technique, introduced by L. L. Mayer and I. C. Sherman at Northwestern University in 1938, permits an instantaneous, sharp, on-off separation of light and dark phases unattainable with the moving sector. Mayer, using the Schweigger hand perimeter and a small neon bulb fitted to a wand as a target, was able to map fusion-frequency fields to the extreme periphery. Since flicker fusion chiefly reflects cone activity, the red-orange light of the neon bulb is an especially suitable stimulus.

In the usual test the succession of light flashes is presented fast enough at first to produce a steady sensation. The rate is then reduced gradually until the subject signals that flicker is just discernible. Repeated daily examinations in normal individuals give a variation of less than one percent. Each measurement takes but three to five seconds.

The testing is best done with surroundings at nearly reception-room illumination since dark adaptation introduces an unnecessary complicating factor and depresses the critical frequency. Corrective glasses may be removed, as ametropia or aphakia does not affect the flicker-fusion rate. Statistically, age and small pupils lower the critical frequency but the average depression is only three flashes per second.

In vascular retinopathy, Weekers found that all functional tests including that of flicker fusion were apparently normal in Stages I and II of the Keith-Wagener classification. He therefore concluded that the neural elements exhibit a considerable factor of safety in their dependence on the circulation. But Krasno and Ivy, by means of a special technique, have demonstrated that just the opposite is true and advocate the sensitive flicker-fusion test as an aid to the early diagnosis of circulatory deficiency at the subclinical level before the blood pressure is elevated or the electrocardiogram abnormal.

The patient's critical frequency as first determined is considered his base-line. A tablet of nitroglycerin (gr. 1/150), is then placed beneath the tongue and the critical frequency measured at two-minute intervals for six minutes. If the postnitroglycerin readings are 60 flashes or more *per minute* above the base-line, vasospasm or vasoconstriction is present. If there is no change or a decrease, the response is normal.

The test has been positive in over 98 percent of cases of known hypertension, arteriosclerosis, coronary disease, or angina pectoris, the increased count varying from 130 to 180 per minute.

Nitroglycerin acts specifically on the circulatory system and improves the fusion frequency of flicker in such patients by causing a more normal flow of blood to the visual nervous system. In the healthy individual, however, nitroglycerin opens the vessels beyond the normally existing optimum. The apparatus used is commercially available from the American Hospital Supply Corporation, Evanston, Illinois.

In visual-field studies certain advantages commend flicker fusion while others favor campimetry. Campimetry is much better for the detection of small, circumscribed scotomas and the delimitation of a defect inasmuch as a target area of less than 1.5 degrees gives a critical frequency too low to be clinically useful. But flicker fusion measures precisely and with automatic simplicity the density of a defect and more surely reveals an extensive, though slight, impairment. The evolution of a lesion is hence more easily followed. Furthermore, flicker fusion is less affected by poor visual acuity and makes less demands on intelligence and attention. A more general use of flicker perimetry can be confidently predicted as it offers the possibility of revealing field defects that cannot be otherwise detected.

James E. Lebensohn.

BOOK REVIEWS

VERNAL CONJUNCTIVITIS. By M. N. Beigelman, M.D. With a foreword by Sir W. Stewart Duke-Elder. Los Angeles, University of Southern California Press, 1950. Clothbound, 430 pp. Price: $6.00.

Vernal conjunctivitis, one of the commonest and most important of external eye diseases, has defied all attempts of investigators to determine its cause. Although it has been generally accepted that it is essentially allergic in nature, specific sensitizing agents are almost never found. Therapeutic studies have for the most part also been disappointing. Beigelman's monograph, based on a personal study of 236 cases and on the histopathologic examination of 36 of them, combined with a review of the literature, serves the very useful and important purpose of summarizing the present knowledge of the disease and of stimulating further research.

The disease is discussed under the headings of nomenclature, history, clinical aspects, histopathology, etiology, and therapy. The chapter on history rightly stresses the outstanding contributions of Arlt, Desmarres, and von Graefe who established the disease as a clinical entity, of Axenfeld whose 1907 monograph summarized critically the literature on the disease up to that time, of Herbert who demonstrated the characteristic conjunctival eosinophilia, and of Gradle who noted the similarity between vernal catarrh and hay fever and laid the foundation for the allergic theory of its etiology.

In the chapter on the clinical aspects of the disease, which is the longest chapter (185 pages) in the book, its various manifestations, differential diagnosis, and relationship to other mucous membrane, skin, and systemic diseases are considered in detail. The chapter on histopathology is well illustrated with black and white and color plates and covers the subject adequately. Under etiology are considered such constitutional factors as autonomic instability, endocrinopathies, temperature effects, micro-organisms, generalized infectious diseases, photosensitivity, avitaminosis, and allergy. The conclusion is reached that hypersensitivity must be considered the most promising working theory.

The concluding chapter on therapy discusses the many and varied agents advocated for control of the disease, from topical applications of astringents and vasoconstrictors to radiation. The most recent agents to be advocated—that is, the antihistaminics and the hormones, ACTH and cortisone, are not given the attention they deserve, but this is no doubt due to the time-lag between submission of the manuscript and publication.

Phillips Thygeson.

DAS SEHEN IN DER DÄMMERUNG. By F. A. Hamburger. Vienna, Springer-Verlag, 1949. Paper binding, 185 pages, 42 figures. Price: Not listed.

This brochure summarizes Hamburger's studies on night vision which were undertaken for the Germany navy from 1942 to 1945. The data are in international-candle units, which Germany first adopted in 1940, instead of the previously official Hefner-candle. The study of night vision is complicated by adaptation, change in the refraction, physiologic central scotoma, and the effects of training. A complete analysis is required for an adequate picture but for certain purposes the examination may be shortened by noting the adaptation curve at 3, 7, and 15 minutes, since the speed of adaptation is most significant both practically and as a test of vitamin-A deficiency. The investigations were done almost entirely with recently developed German apparatus, such as the Nowak-Wetthauer instrument (1943) and the Comberg nyktometer, with which few Americans are yet familiar.

James E. Lebensohn.

ESSENTIALS OF OPHTHALMOLOGY. By Roland I. Pritikin, M.D. Philadelphia, J. B. Lippincott Co., 1950. Clothbound, 561 pages, 215 illustrations including 18 in color, index. Price: $7.50.

This volume on the eye and its diseases is the ninth of a series on "Essentials" published by the same firm, and designed to provide concise and effective working manuals for the busy physician. The quality of binding, paper, printing, and illustration is a model of book-making art. This reviewer, lacking the lenity of Whittier, cannot forebear further comment. The effective optical illustrations have an original third-dimension quality, but the other pictures, though well done, are for the most part too familiar, including those in color.

The orientation paragraphs preceding each section give the impression that Pritikin, an able and experienced ophthalmologist, has just the proper perspective. With the notable exception of a fine chapter on legal ophthalmology, the text does not match the prospectus. Everything ophthalmologic is included in sketchy detail but the items of most concern to the general practitioner are insufficiently elucidated. This comprises emergency procedures, as the removal of rust scale from the cornea; essential differential diagnosis, as in the distinction of thyrotoxic from thyrotropic exophthalmos; and ample explicit particulars on medical therapy. The use of the electric retinoscope in Figure 65 is not clarified by the prominent projecto-chart instrument in the scene. No direct reference to the illustrations occurs in the text including even that of the author's own hand tangent screen—an apparatus quite similar to that introduced by Luther Peter 25 years ago. In cavernous sinus thrombosis, nystagmus is listed as a symptom but no mention is made of edema over the mastoid, early abducens involvement of the other eye, or the Crowe-Beck sign. Table 16, on the choice of bifocals, specifies a point below the segment-top as 0.5 mm. when 5.0 mm. is meant.

This publication seems unlikely to jeopardize the intrenched position of the authoritative handbooks already in this field.

James E. Lebensohn.

OPHTHALMIC MINIATURE

Sir

I received safely the spectacles & glasses you were so kind as to send me by Mr. Mackie, and now inclose you a 20. Dollar bill of the bank of the U.S., the amount of their cost. The smallest pair of spectacles I am charmed with; they answer perfectly my wish. The other pair with double glasses I have not yet had time to try sufficiently and get them to fit my eye exactly. I have no doubt they also will answer my expectation. Accept my salutations and best wishes.

Th. Jefferson

Mr. John McAllister
48 Chestnut Street
Philadelphia.

From an original letter in the collection of James W. Smith, M.D., New York.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Sebruyns, M. **Ultrastructure of the cornea and lens studied with the electronic-microscope.** Ann. d'ocul. **183**:483-494, June, 1950.

Many existing conceptions concerning cell structure need revision. Under magnifications of 15,000 to 20,000 diameters, electronic microscopic studies show that living cells are much more complex than we have thought. Both nuclei and protoplasm contain innumerable capillary tubes and vacuoles, as well as granular matter. The capillary tubules and vacuoles are from .3 to .6μ in diameter and vary in number and arrangement in different tissues.

The basal membrane of the corneal epithelium has a spongy appearance which is due to a vacuolar arrangement resembling that in the renal glomeru. The more anterior layers have a firmer structure. The stromal cells have a helical arrangement which facilitates transparency. In the lens capsule the vacuoles are smaller and less uniform. In the nucleus they are more rectangular. This is apparently associated with increased viscosity. (9 figures)

Chas. A. Bahn.

Wilmer, H. A., and Scammon, R. E. **Growth of the components of the human eyeball. I. Diagrams, calculations, computation and reference tables. II. Comparison of the calculated volumes of the eyes of the newborn and of adults, and their components.** Arch. Ophth. **43**:599-637, April, 1950.

This scholarly, detailed work contains a great number of data presented in the form of tables, graphs and diagrams. In summary, the authors state that the eyeball increases a little less than threefold between birth and maturity. The ranges of postnatal increases in calculated volumes of the parts of the eye are considerable. The greatest relative postnatal gain in calculated volume is seen in the iris, ciliary body and choroid. The growth of the lens, retina, anterior chamber, cornea and intrabulbar portion of the optic nerve is distinctly less than that of the eyeball as a whole.

John C. Long.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Evans, C. A., and Moore, G. E. **The effects of viruses on intraocular tissues: infections with the viruses of herpes simplex, feline agranulocytosis and ornitho-**

sis. J. Infect. Dis. **87**:1-9, July-Aug., 1950.

The virus of herpes simplex causes very few grossly observable changes when injected into the eye of a rabbit. Microscopic changes are found in all neural elements of the retina and in the fibroblasts, radial and circular muscle of the iris and in the muscle and pigmented and non-pigmented epithelium of the ciliary body, and in macrophages and also in a a single endothelial cell of the cornea. The virus of feline agranulocytosis also showed very few grossly observable changes in the eye, but microscopic changes were multiple. This virus often causes fatal systemic infection. The virus of ornithosis showed a severe reaction grossly, with signs of acute inflammation in and around the filtration angle. The reason why some cells are not infected by these viruses while the adjoining cells may show gross or microscopic changes is discussed. (9 figures, 1 table)

H. C. Weinberg.

Hallermann, Wilhelm. **The problem of nervous regulations of chronic inflammations of the eye. Clinical and experimental studies.** Arch. f. Ophth. **150**:201-244, 1950.

Fifty-six cases of unilateral amblyopia were found in 7,700 patients with chronic uveitis. The uveitis had developed in the amblyopic eye 12 times. This observation suggested a regulatory nervous mechanism. However, experiments did not confirm the author's assumption. A retrobulbar injection of alcohol did not change the course of an anaphylactic uveitis produced by injections of horse serum into rabbits; retrobulbar dissection of the optic nerve did not show any effects in similar experiments nor did removal of the superior cervical ganglion.

Ernst Schmerl.

Lepri, G. **The action of para-aminosalicylic acid on some pathogenic microorganisms.** Atti d. 37 Congresso Soc. oftal. ital. **10**:570-571, 1948.

The bacteriostatic effect of PAS on microorganisms (except on Koch's bacillus) is negligible. The effect on Koch's bacillus is enhanced when a sulfone is added and is decreased when an antibiotic is given simultaneously. All these experiments were done in vitro.

Frederick C. Blodi.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Azzolini, U. **Corneal deposits of heavy metal salts.** Boll. d'ocul. **29**:156-163, March, 1950.

The histologic, chemical, and physicochemical problems involved in the collection of metallic compounds near or in the elastic membranes of the eye are discussed. The affinity of the heavy metals for vitreous membranes is still unexplained. The chemical changes of their salts in the body, their degree of dispersion, the electric colloid charge, and light are possible factors.

K. W. Asher.

Bietti, G. B., and Ferraris de Gaspare, P. F. **Effects of oxygen inhalation on scotomas.** Boll. d'ocul. **29**:29-52, Jan., 1950.

In normal eyes, campimetric examination revealed no definite changes of the 1:2000 isopter of the visual field after inhalation of pure oxygen at atmospheric pressure. In glaucomatous eyes, this procedure was often followed by an enlargement of the partly constricted fields and by recession of pathologic scotomata; this was independent of the pressure conditions and occurred also in eyes normalized by surgery. Oxygen inhalation can also influence central scotomas of various etiology. Slight improvement was observed in cases of hemianopsia of central origin; in degenerative retinal diseases such as retinosis pigmentosa and myopic atrophy no improvement was noted, while macular degenerations (type Stargardt) showed satisfactory results. No influence

of oxygen was found in cases of retinal detachment. Retinitis and choroiditis showed improvement, even in old cases. Amblyopia of strabismus was improved, not only as far as central and paracentral scotomas are concerned, but also in the sense of a reduction of an enlarged blind spot. Eyes with thrombosis of the retinal vein did not improve but in one of two eyes with occlusion of the retinal artery the scotoma receded 2 or 3 degrees. All results reported here were of rather short duration; subconjunctival administration of oxygen produced less marked but more lasting results. Abridged histories and visual fields of 36 patients are displayed.

K. W. Ascher.

Birren, J. E., Casperson, R. C., and Botwinick, J. **Age changes in pupil size.** J. Gerontology **5**:216-221, July, 1950.

Measurements of pupils were made from photographs, taken by a flash discharge of 0.0002 sec., of 222 subjects from 20 to 89 years of age after adaptation to complete darkness and to a brightness of 1 millilambert respectively. A progressive decrease in pupillary diameter from the third to the seventh decade occurred in both situations: from an average of 5.1 mm. to 3.5 mm. in light adaptation, and from 7.4 mm. to 4.8 mm. in the dark. Neither skin pigmentation nor iris color affected the size of the pupil. No change in pupillary measurements occurred after the seventh decade. The curve of decrease is not rectilinear as previously assumed but slightly curvilinear. The smaller pupil accounts for one third the elevation in light threshold present in the aged. Regardless of age the relative constriction is apparently constant, the pupil in the light being about two thirds the diameter of that in the dark. James E. Lebensohn.

Corrado, M. **The Horner pupil and its relation to the double innervation of the ciliary body.** Atti d. 37 Congresso Soc. oftal. ital. **10**:387-388, 1948.

The accommodation was measured in three patients after a novocain block of the stellate ganglion. The effectiveness of the block could be evaluated by the appearance of Horner's syndrome. The changes in the amplitude of accommodation following this injection lead the author to believe that there is a double (sympathetic and parasympathetic) innervation of the ciliary muscle.

Frederick C. Blodi.

Dartnall, H. J. A. **Colour photography of visual purple solutions.** Brit. J. Ophth. **34**:447-448, July, 1950.

During experiments of spectrographic investigation of visual purple it was necessary to prepare solutions of larger amounts than had ever been attempted previously. About 100 dark-adapted frogs were used to prepare 50 to 70 cc. of solution which was extracted in darkness or in dim red light. An opportunity presented itself to take color photographs of the solution before and after its exposure to light. Two color photographs are shown, the first taken immediately after the flask was removed from its light-free container, and then after exposure to a 100 watt lamp. In the first photograph the solution is a red purple while in the second its has become a yellow orange. (2 figures in color) Morris Kaplan.

François, J., and Philips, A. **Inversion of the pupillary reaction due to adrenalin.** Ann. d'ocul. **183**:570-579, July, 1950.

Miosis following the instillation or subconjunctival injection of adrenalin is rare. The authors report in detail the case of a 48-year-old man in which this unusual condition existed in the right eye only. The patient had the residua of an interstitial keratitis and chorioretinitis in both eyes, due to congenital lues. Cocaine and atropine locally produced only slight dila-

tation in the right eye and acted normally in the left. Practically the only extraocular abnormality observed was a hypercalcemia which the authors consider the cause of the anomaly. Chas. A. Bahn.

Friedenwald, J. S. **Recent studies on corneal metabolism and growth.** Cancer Research **10**:461-466, August, 1950.

The corneal stroma, having no oxygen uptake, produces lactic acid in its consumption of glucose. This lactic acid represents over one quarter the carbohydrate utilized by the corneal epithelium. The stroma-epithelium boundary is relatively impermeable to crystalloids, though permeable to water and lipoid-soluble substances. The adhesion of the corneal epithelium to the underlying stroma is loosened by detergents and local anesthetics. Mitotic activity in the corneal epithelium is limited to its two basal layers. In wound healing the first reaction is migration of adjacent cells, and cellular multiplication plays but a later and secondary role. Local anesthetics inhibit both processes. James E. Lebensohn.

Gandolfi, C., and Bottoni, A. **Clinical observations on the retinal circulation after ligation or resection of the jugular veins.** Ann. di ottal. e clin. ocul. **76**:137-143, May, 1950.

The authors studied the retinal circulation, both ophthalmoscopically and by measurement of the intraocular venous and arterial pressure, in 10 persons whose jugular veins were ligated or resected because of neoplasms in the pharyngolaryngeal region with metastases to the cervical lymph nodes. Except in one case where there was retinal edema which lasted only a few days, no significant alterations in the retinal circulation were observed. Evidently a vicarious circulation by way of the vertebral veins is promptly established after interruption of the flow in the jugulars. The very slight lowering of the retinal arterial pressure observed in some cases seems to be due to the lowering of the general arterial pressure consequent on loss of blood and surgical trauma. None of the patients reported any disturbance of vision, and the ocular tension remained unaltered. (References) Harry K. Messenger.

Giardini, A. **The glucose content of the tears.** Atti d. *37* Congresso Soc. oftal. ital. **10**:391-395, 1948.

The glucose was determined according to the micro-method of Hagedorn-Jensen. The mean value in normal patients was 0.102 percent. There was no connection between the glucose content and the way the secretion of the tears was stimulated or any disease of the anterior segment. There is usually a slight increase in the glucose level in diabetic patients; but there is no direct correlation with the glucose level in the blood.

Frederick C. Blodi.

Lepri, Giuseppe. **Experimental study on the efficiency of different substances in retarding the absorption of penicillin introduced into the subconjunctival spaces.** Brit. J. Ophth. **34**:425-430, July, 1950.

The purity of penicillin is such that it is possible to get concentrations of 1 million units in 0.5 cc. of diluent. These high dosages bring about high concentration in aqueous and ocular tissues but do not prevent the rapid elimination from the subconjunctival space. The results of studies of various diluents to impede this elimination of the antibiotic are presented. In a series of rabbit experiments, penicillin was dissolved in 1:1000 adrenalin, pectine, procaine and procaine-pectine. The two pectine preparations had no appreciable beneficial effect while the adrenalin and the procaine served very well to prolong the intraocular concentrations of the penicillin. 100,000 units were dissolved in 0.05 cc. of the adrena-

lin and used in the aqueous suspension of procaine-penicillin G. The former promoted high intraocular penicillin levels and also more persistent blood concentrations while the latter promoted higher intraocular levels. Morris Kaplan.

Morone, G. **Pupillographic studies on the fatigability of the iris.** Atti d. 37 Congresso Soc. oftal. ital. **10**:451-452, 1948.

According to the author, it takes 300 to 400 stimuli to show a fatigue of the pupillary reaction. Before this fatigue sets in, a mydriasis can be noted. Vitamin B_1 restores the pupillary reaction. The method is not described. Marucci points out in the discussion that he also found more stimuli necessary to show a pupillary fatigue than originally indicated by Loewenstein. Frederick C. Blodi.

Poos, F. **The ocular circulation.** Arch. f. Kreislaufforschung **16**:18-51, May, 1950.

In this comprehensive study Poos stresses the characteristics that affect the ocular circulation because of the enclosed tension space, and analyzes the relations of the ocular circulation to that in the connecting tension spaces of orbit and brain. The intrabulbar pressure is in dynamic equilibrium with the extrabulbar pressure exerted by the muscle funnel. With the increased blood that accompanies each systole there is a functional synchronized outflow of venous blood from the three cavities. The ampullae of the vortex venins, like the venous sinuses of the brain, serve to minimize changes in blood volume. Since the intraocular tension is far greater than that of any other tissue, the vessels supported by this tension are consequently very thin-walled. Hence there is a vascular reaction in diabetes, renal insufficiency and anemia that does not occur in other tissues. The posterior pole is the functional vascular center of the eye, and therefore a vascular disturbance tends to produce a concentric focal localization of exudates and degenerations. James E. Lebansohn.

Rosso, S. **The effect of some amino acids on the accommodation.** Atti d. 37 Congresso Soc. oftal. ital. **10**:413-414, 1948.

In instances in which a weakness of accommodation (postdiphtheric, premenstrual) was refractory to vitamin B_1, glycin has been used with success. The author injects 2 cc. of a 2-percent solution intramuscularly. Frederick C. Blodi.

Szilagyi, T., and Hahn, G. **The effect of ferrous iron on pupillary reactions.** J. Pharm. and Exper. Therap. **98**:331-336, April, 1950.

Since the presence of ferrous iron diminishes the effect of certain drugs, the authors tested pupillary dilatation with and without the presence of ferrous salts. Ferrochloride solutions were administered with other agents subconjunctivally in rabbits. The effect of ferrous iron in blocking the action of epinephrine is not specific. The action of epinephrine, eserine, and cocaine is reduced or blocked by ferrous iron in three- to sixty-fold quantities. To obtain the same effect upon the action of atropine and scopolamine much larger (300-600-fold) quantities of ferrous iron are required. After sympathetic denervation the dilator smooth muscle of the iris becomes more sensitive to the action of epinephrine and the mydriatic effect can only be blocked by considerably higher doses of Fe^{++}. Mydriasis caused by the stimulation of the cervical sympathetic nerve is also inhibited by ferrous iron. These results may be explained as follows: 1. ferrous iron in high doses reduces the reactivity of smooth muscles; 2. in smaller does it blocks the effect of the drugs mentioned above, without exerting a direct effect. (References)

Bennett W. Muir.

Weigelin, E., and Niesel, P. **The blood pressure of the retinal arteries in changing positions of the body.** Arch. f. Ophth. **150**:374-384, 1950.

The authors used H. K. Mueller's dynamometer and studied more than 200 patients. They found an average increase in the diastolic pressure of 7.5 mm. Hg when the patient changes from the upright to the completely horizontal position. Changes of the systolic pressure may become even more pronounced. However, with even a slight elevation from the horizontal position these changes are absent.

Ernst Schmerl.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Auerswald, W., Bornschein, H., and Zwiauer, A. **The range of physiologic variability as a statistical basis for the evaluation of dark adaptation.** Arch. f. Ophth. **150**:301-316, 1950.

The authors studied the dark adaptation of 268 persons 20 to 30 years old and 85 persons 40 to 50 years old. After a discussion of the mathematical and experimental methods, the following results are presented. With emmetropic persons of both age groups the frequency-distribution of the logarithms of the light intensities corresponds to the normal curve of variation (Gaus's curve). In ametropics this correspondence is somewhat less satisfactory. Sensitivity to light stimuli and night vision of the older age group are significantly diminished. Finally a formula is presented which permits comparison of a single case with the average value obtained from the studies described in this paper. Ernst Schmerl.

Cibis, P., and Kolter, R. **Spatial deformation by the media of an unusual index of refraction.** Arch. f. Ophth. **150**:279-300, 1950.

The authors study the effect of thick glass plates upon stereoscopic perceptions. They find the spatial deformations which take place completely explained by geometric-optical conditions. Physiologic or psychic factors are not involved. The stereoscopic impression of physical objects becomes more pronounced, the threshold for depth-perception lowered. Experiments and mathematical discussion are presented in detail. Ernst Schmerl.

Hardy, L., Rand, G., and Rittler, C. **Test for color vision.** Ann. d'ocul. **183**: 515-518, June, 1950.

Approximately two hundred tests for color vision were studied and grouped as follows: 1. of academic interest only; 2. too complicated for practical use; 3. of value only as a rough screening test; 4. designed for determining qualitative defects only; 5. designed for determining quantitative and qualitative defects; 6. designed for special uses or industries. The purpose of this contribution is to better inform French ophthalmologists concerning the plans and accomplishments of the Inter-Society Color Council in standardizing tests for color vision.

Chas. A. Bahn.

Hardy, L., Rand, G., and Rittler, C. **Color vision and recent work in the testing of color vision.** Ann. d'ocul. **183**:519-532, June, 1950.

This contribution was originally published in the Archives of Ophthalmology during 1946. Its present purpose is to better inform French ophthalmologists concerning the Inter-Society Color Council and its efforts to standardize color vision tests and nomenclature.

Chas. A. Bahn.

Ohm, Johannes. **Reversal of dark adaptation.** Arch. f. Ophth. **150**:317-328, 1950.

The author describes extensive and systematic observations of his own visual sensations in the dark and offers a tentative

explanation which he is in a position to do because of his exhaustive studies of nystagmus in miners. Ernst Schmerl.

Poos, F. **The genesis of spheric and aspheric refraction.** Arch. f. Ophth. **150**: 245-278, 1950.

The author presents an integrated theoretical account of the factors which produce the refractive state of the eye.
Ernst Schmerl.

Weber, R. A. **Ocular fatigue.** Arch. Ophth. **43**:257-264, Feb., 1950.

Eight subjects were studied in detail while doing close work under artificial illumination. Attempts were made to determine the effects of fatigue. The author concluded that there does not appear to be any loss of acuity for either near or far, decrease in speed of accommodation or loss of strength of the extraocular muscles as a result of the fatigue of a working day. "Ocular fatigue" is probably a form of professional cramp, a focal cerebral fatigue similar to writer's cramp. Apparently the optimum illumination for reading, evenly distributed, of good quality, without glare source, is in the neighborhood of 20 foot candles at the working surface. John C. Long.

5

DIAGNOSIS AND THERAPY

Berens, C., and Tolman, C. P. **An ocular hypertension indicator (tonometer).** J.A.M.A. **142**:1360, April 29, 1950.

The authors have developed an ocular hypertension indicator which one might say is a simplified tonometer, which gives readings that indicate whether the ocular tension is above or below normal. This was designed to be placed in the hands of general physicians, so that screening could be done on many more patients than is accomplished now, with resultant detection of borderline or obvious glaucoma. (1 figure) Bennett W. Muir.

Chace, R. R., and Lafayette, J. H. **A lighting system for photography of the eye.** Arch. Ophth. **43**:371-373, Feb., 1950.

A system of anterior-segment photography is described using a high speed Wilcox strobolite as a light source.
John C. Long.

Epstein, E. **An ophthalmoscope for use in operations.** Arch. Ophth. **43**:373-375, Feb., 1950.

This instrument consists essentially of a headlamp and perforated mirror worn on a head band. The use of accessory lenses held before the eye and of a modified spectacle makes it possible to do direct and indirect ophthalmoscopy while surgery is in progress. The device has been used in retinal detachment surgery, and in the removal of non-magnetic foreign bodies and a cysticerus from the vitreous. John C. Long.

Fedrizzi, G., and Ferri, L. **Roentgen therapy of superficial ocular lesions.** Atti d. 37 Congresso Soc. oftal. ital. **10**:435-439, 1948.

The authors give the results at the clinic in Pavia. The factors were: 30 to 40 r every second day up to 180 to 320 r; 25 cm. target-skin distance; 55 K. V.; 0.5 mm. aluminum filter. With these rays of low penetrating power, good results were obtained in herpetic keratitis, bullous keratitis, episcleritis, scleritis and others. Poor results were seen in vascularization of corneal grafts, epithelial dystrophy of the cornea and other lesions.
Frederick C. Blodi.

Fenner, W. **The use of artificial resin for the production of eye prosthesis and eye implants.** Klin. Monatabl. f. Augenh. **116**:382-390, 1950.

The author reports on the use of plastic material in the production of artificial eyes and bulbous implants and he describes its advantage over glass eyes. He

reports, furthermore, on experiments made in the United States to unite artificial eyes with implants and the suturing of implants to eye muscles.

R. Grunfeld.

Fuchs, J. **Two new kind of uses of contact cups made of plexiglass.** Klin. Monatsbl. f. Augenh. **116**:376-382, 1950.

A contact glass with artificial iris and pupil was made for a patient who had a very large artificial coloboma and poor vision. The contact glass also corrected the high astigmatic error. Vision improved from 1/50 to 5/12. A black contact glass is recommended for apprehensive patients to cover their eyes during operations on lids and tearducts.

R. Grunfeld.

Grün, P., Funder, W., and Wyt, L. **The effect of ultrasonic vibration on the vitreous and on the lens.** Klin. Monatsbl. f. Augenh. **116**:358-367, 1950.

Ultrasonic vibration liquifies the vitreous irreversibly. The liquification can be accelerated by blowing air into the eyeball or by producing a fistula. Ultrasound treatment caused various lens changes in dead animals but not in lenses of living animals. R. Grunfeld.

Guenther, G. **Dacryocystorhinoscopy.** Arch. f. Ophth. **150**:405-410, 1950.

The author devised a dacryocystorhinoscope with which the surgeon can check the results of the Toti operation.

Ernst Schmerl.

Hallermann, W., and Ladeburg, H. **Ultrasonic treatment of the eye.** Klin. Monatsbl. f. Augenh. **116**:355-358, 1950.

The authors warn against ultrasonic treatment of the eye until we know more about its effect and method of action. Ultrasonic vibration represents a very effective energy. It represents pressure variations of 5 to 10 atmospheres and very high acceleration, about 100,000 times the speed of the earth's rotation.

R. Grunfeld.

Hruby, K. **Slitlamp microscopy of the posterior section of the eye with the new preset lens.** Arch. Ophth. **43**:330-336, Feb., 1950.

A method for the slitlamp examination of the posterior segment of the eye is described. The light source and the microscope make a narrow angle. A special minus 55 D lens is held before the eye, which makes the use of a contact lens unnecessary. This type of examination has been very useful in the study of the vitreous, of retinal detachments, and of choroidal tumors. John C. Long.

Jaensch, P. A., and Budde, H. **Priscol in the treatment of the retina and optic nerve.** Klin. Monatsbl. f. Augenh. **116**: 267-275, 1950.

Priscol is a strong vasodilator, the blood vessels dilate widely, even collapsed corneal arteries become blood filled after its local application. Corneal opacities of keratitis parenchymatosa, keratitis dendritica, or chemical burn cleared more rapidly with the treatment of priscol than with other forms of treatment. Priscol, given orally in tablets or intravenously, did not visibly dilate the retinal vessels, but it acted favorably in toxic neuritis, retrobulbar neuritis, and in hypotensive retinitis. Good results were noted in the so called embolus of the central retinal artery in younger persons where the obstruction was due to spasm of the artery. It was ineffective in older patients where the embolus was associated with organic changes of the vessel wall. No improvement was noted in thrombosis of the central retinal veins. Vision improved and the central scotoma disappeared in the treatment of juvenile and senile macular changes when the treatment was begun before organic changes had supervened.

R. Grunfeld.

Knüpffer, Nicolai. **The results of treatment with privin and antistin-privin in allergic conjunctivitis.** Klin. Monatsbl. f. Augenh. **116**:304-309, 1950.

The author produced allergic conjunctivitis through instillation of tuberculin and compared the therapeutic result achieved by the administration of astringents and antistin-privin. The therapeutic value of the latter was far superior to the action of the astringents. R. Grunfeld.

Kronenberg, Bernard. **A new sclerotomy knife.** Arch. Ophth. **43**:370, Feb., 1950.

This knife has an angled blade, tapered edge and broad cutting belly. The design is aimed to provide an instrument which will avoid cutting too deeply when making a sclerotomy incision.

John C. Long

Lamont, Edward S. **Plastic surgery about the eye.** Am. J. Surg. **79**:824-831, June, 1950.

Accepted generalities concerning adnexal surgery are presented, and the author lists more than a score of different procedures which can be performed. The procedures used in seven illustrative cases are shown in photographs and diagrams. Reference is made to ptosis repair, various implants, and protheses.

Alston Callahan.

Löhr, K. **Indications and method of privin therapy on the eye.** Klin. Monatsbl. f. Augenh. **116**:285-292, 1950.

Privin is a strong vasoconstrictor. Locally applied in 1:100 to 1:10,000 solution it relieves photophobia and blepharospasm, suppresses inflammatory symptoms and prevents the development of secondary lesions. It is most useful in simple, chronic, allergic, vernal, and phlyctenular conjunctivitis, parenchymatous keratitis, and stenosis of the tearduct.

R. Grunfeld.

Maione, M. **Applications of infrared rays as a therapeutic method in certain conjunctival affections.** Ann. di ottal e clin. ocul. **76**:87-90, March, 1950.

Good results were achieved in the treatment of vernal and phlyctenular conjunctivitis and of blepharoconjunctivitis resistant to other treatment, by 5 to 10-minute exposures to radiation from a 150-watt infrared lamp at a distance of one meter. The therapeutic effect of the radiation is thought to be due to the hyperemia induced. Harry K. Messenger.

Nigro, L. **The importance of the systolic pressure of the retinal artery.** Atti d. 37 Congresso Soc. oftal. ital. **10**:573-574, 1948.

An obliterating vascular process may be the cause of a big difference between the systolic pressure in the retinal artery and in the brachial artery.

Frederick C. Blodi.

Peiffer, H. **Treatment of allergic diseases of the eye with a new anti-histamin preparation, antistin.** Klin. Monatsbl. f. Augenh. **116**:293-304, 1950.

The author reports the successful use of antistin, an antihistamin preparation, in ophthalmic practice. Antistin was given orally, parenterally, and in the form of eyedrops. The results were good in allergic eye conditions and excellent in the treatment of photophobia and tearing in phlyctenular diseases. R. Grunfeld.

Peterkin, G. A. G. **Some dermatological conditions affecting the adnexa of the eye.** Tr. Ophth. Soc. U. Kingdom **68**:353-361, 1948.

The author discusses the diagnosis and treatment of some of the skin conditions about the eyes. For benign angiomata the use of Grenz rays, Finsen-Lomholt light or thorium X and a cream to act as a covermark can be considered. Cavernous angiomata can be radiated with 450-600

r properly screened. Pigmented and mixed naevi should be left alone. Basal-cell or squamous-cell carcinomata differentiated by histologic study can be treated by diathermy or implantation of radium or radon seeds. Warts due to filterable virus can be removed by diathermy. Xanthelasma is effectively removed by painting with 50 percent trichloracetic acid. Cutaneous leishmaniasis may be recognized by the finding of the Leishman-Donovan bodies which may not appear for two years after returning from affected areas. Treatment is satisfactory with radiotherapy and beberine acid sulphate injections. Drug eruptions include contact dermatitis, blepharitis, and angioneurotic edema and allied diseases.

Systemic diseases such as scleroderma, Reiter's disease, and Behcet's syndrome associated with conjunctival involvement do not respond well to any treatment. Stevens-Johnson's disease apparently related to erythema multiforme may occur after sore throat or respiratory disease and no treatment is effective. For pemphigus no treatment has been found effective. In dermatomyositis there is swelling and discoloration of the eyelids associated with atrophy, telangiectasia and a reticulated pigmentation of the skin and in later stages there may be cataract. The mortality is high and the etiology is unknown. Some patients with rosacea and its ocular complications of keratitis and corneal ulceration may respond to large doses of riboflavin (10 to 50 mgm.) injected intramuscularly two or three times a week, yet others do not show the slightest improvement. Beulah Cushman.

Preston, F. E. **The use and abuse of topical ocular therapy.** Tr. Ophth. Soc. U. Kingdom **68**:319-327, 1948.

The author recommends pyrogen-free distilled water to irrigate the anterior chamber and in solutions where a larger quantity than 10 cc. of distilled water must be injected. As a preservative added to all drops he recommends the use of chlorocresol. Drops should be buffered. Solutions affected by light should be dispensed in amber-colored bottles or in stoppered bottles if prone to oxidation. Sodium metabisulphite added to adrenalin has proved satisfactory to delay its oxidation. Beulah Cushman.

Ridley, Frederick. **The use and abuse of topical ocular therapy.** Tr. Ophth. Soc. U. Kingdom **68**:301-318, 1948.

The salt concentration of the tears is about 0.65 percent, therefore a saline solution of 0.65 percent is much more comfortable than the 0.9 percent so frequently used. The lysozyme content of the tears was estimated, and experiments conducted to show that the lysozyme will destroy streptococci, staphylococci, pneumococci, and many other organisms. Atropine tends to reduce the amount of tears, therefore, in infections, hyoscine is to be preferred as a mydriatic. The dilution of the drug by the tears must be taken into consideration. Drops are diluted to one half their initial strength every 45 seconds, and most of them reach a dilution of one-thousandth of their initial concentration within eight minutes. Silver nitrate and copper sulphate destroy lysozyme but penicillin and the sulpha drugs have no deleterious effect on lysozyme. A true emulsion of either oil in water or water in oil may be used for eye ointments. Drugs may induce or prevent an allergic reaction in the eye. The majority of reactions are probably chemical irritations, and in about twenty-five percent may be truly allergic. Allergic patients will not tolerate any effective mydriatic unless they are first desensitized either by repeated injection of a serum-atropine desensitizer or by one of the new antihistaminic drugs used either locally or generally. The histamine-like body found in normal tears may be a factor in any of the allergic responses of

the eye. If one half percent atropine were used instead of one percent one third of the cases of atropine irritation would be eliminated. Beulah Cushman.

Rizzuti, A. B. **High speed photography of the anterior ocular segment.** Arch. Ophth. **43**:365-369, Feb., 1950.

The author describes the use of the Edgerton repeating flash bulb and Speed Graphic camera for high speed photography of the anterior ocular segment. This flash bulb yields 42 million lumens of light for 0.001 second during a flash. The color value of the light makes it suitable for color photography. John C. Long.

Robson, J. M. **Advantages and disadvantages of local application.** Tr. Ophth. Soc. U. Kingdom, **68**:329-337, 1948.

Much higher concentrations can be obtained with the local application of medicaments without subjecting the whole body to their action, and side effects are rarely seen. Drops should be instilled at least six times a day. By iontophoresis the concentration in the eye of the drugs applied to the conjunctival sac can be markedly increased. Detergents decrease the surface tension by altering the permeability of the corneal epithelium and are of special value in the use of sodium sulphacetamide and streptomycin. A subconjunctival injection acts as a depot from which the drug is slowly absorbed; this effect can be enhanced by adding a vasoconstrictor such as adrenalin. Intravitreous administration maintains a chemotherapeutic concentration in the ocular tissues for as long as two days.

Beulah Cushman.

Scholtyssek, H. **Treatment of the anterior portion of the eyeball with adrianol eye drops.** Klin. Monatsbl. f. Augenh. **116**:275-284, 1950.

The author used adrianol in inflammatory diseases of the anterior part of the eye. Favorable results were obtained in the treatment of acute eczematous corneal ulcers and scars and in clearing of old scars of whatever origin. Its favorable action may be ascribed to its affect on the sympathic, to its antiallergic property, and its ability to prevent superfluous vessel formation in the cornea. Adrianol may be useful after intraocular operation to reduce corneal edema. R. Grunfeld.

Stallard, H. B. **A head-clamp for orbital operations.** Brit. J. Ophth. **34**:449, July, 1950.

A new type of head-clamp is suggested for use in orbital surgery. The head is firmly held in an arcuate clamp and is protected by sponge rubber pads covering the screw locks. The head can be maintained at any rotation or inclination. (1 figure) Morris Kaplan.

Stallard, H. B. **A plastic disc for retention of a corneal graft.** Brit. J. Ophth. **34**:450, July, 1950.

An improvement of Pittar's tantalum ring is described in which the two parts of the support are made of transparent plastic to enable constant inspection of the edges of the graft. (1 figure)

Morris Kaplan.

Stallard, H. B. **A non-magnetic foreign-body extractor.** Brit. J. Ophth. **34**:511-512, Aug., 1950.

A new non-magnetic foreign body extractor is described which consists of a slender hollow shaft, through which a steel passes whose end is split to form a pair of tiny extractor jaws which are easy to manipulate under guidance of an ophthalmoscope. The instrument is inserted through a small scleral incision which is completely filled by the shaft of the instrument. In this way leakage of vitreous is kept to a minimum.

Orwyn H. Ellis.

Walsh, F. M. **Ophthalmic headache: a differential study.** Journal-Lancet **70**: 259-263, July, 1950.

The salient features in headache arising from ocular orgin are briefly discussed. Hyperopia, and myopia made hyperopic by lenses which are stronger than need be, and lenses which induce the effect of a prism are frequent causes of headache. Ciliary hypertonicity, allergies, iritis, hypertension, cervical arthritis, brain injuries neuralgias, mental tension and migraine are reviewed as possible causes of headache. H. C. Weinberg.

Williamson-Noble, F. A. **Dark glasses.** Brit. J. Ophth. **34**:513, Aug., 1950.

Inexpensive, protective, dark glasses are made from war-surplus eye shields for the use of patients after intraocular surgery. They are efficient and comfortable. Orwyn H. Ellis.

6

OCULAR MOTILITY

Bietti, G. B., and Giardini, A. **Ocular motility in anoxia. II. The influence of anoxia and/or alcohol.** Atti d. 37 Congresso Soc. oftal. ital. **10**:485-486, 1948.

During anoxia there is usually esophoria for distance and an insufficiency of convergence for near. In some cases there is also a hyperphoria. The same tendencies occur under the influence of alcohol and are still more pronounced when anoxia is combined with the administration of alcohol. Frederick C. Blodi.

7

CONJUNCTIVA, CORNEA, SCLERA

Benedict, W. L. **Ophthalmia neonatorum.** J. Michigan St. M. Soc. **49**:560-565, May, 1950.

No suitable substitute for 1-percent silver nitrate solution as a prophylactic agent has been found in the long list of new bacteriostatic drugs. Established health measures should not be abandoned until better measures have been undisputably proved. Irwin E. Gaynon.

Bonavolontà, A., and Zeppa, R. **Tissue therapy in trachoma.** Riv. ital. d. tracoma e di pat. oculare esotica **1**:21-24, July-Sept., 1949.

The authors review the reports of Russian authors on the use of implants of various tissues, both fresh and preserved, in the treatment of pannus. Several modifications were made in the method since it was felt that some of the procedure was too dangerous. The results as reported by the author were no better than those following peritomy. The only improvement seen was in those cases in which the implant was placed in the superior quadrant. Francis P. Guida.

Cima, V. **Bilateral fatty degeneration of the cornea.** Atti d. 37 Congresso Soc. oftal. ital. **10**:382, 1948.

The author describes the primary and secondary forms of lipoid degeneration of the cornea. A case is presented with a secondary lipoid degeneration of both corneas in a young woman. These deposits of lipoid were secondary to corneal maculae following a phlyctenular keratoconjunctivitis. A keratoplasty was performed on both eyes, with good results. The histologic examination revealed several areas of scar tissue in which fat could be found with the appropriate staining methods. Frederick C. Blodi.

Croll, M., and Croll, L. J. **Corneal transplantation.** J. Michigan St. Med. Soc. **49**: 442-449, April, 1950.

Favorable for corneal transplantation are: keratoconus, interstitial keratitis that has been inactive one year or more, and a central scar surrounded by healthy cornea. Partially favorable are all the corneal dystrophies except the two to be men-

tioned as unfavorable. Unfavorable are eyes with nystagmus, or lime burns, eyes with much vascularization, uveitis, corneal scars extending to the periphery, dystrophia adiposa and Fuchs's dystrophy. The various techniques, complications and treatment are discussed.

Irwin E. Gaynon.

Damato, F. J. **A case of watering eye due to pterygium.** Brit. J. Ophth. **34**:509-510, Aug., 1950.

A patient had lacrimation which was only relieved after successful operation for recurrent pterygium. The pterygium had been adherent to the upper lid and had caused inversion of the region of the lacrimal punctum.

Orwyn H. Ellis.

Fialho, S. A. **Conservation of the cornea of the cadaver by immersion of the eye-ball in paraffin oil maintained at 4-6 degrees C.** Ann. d'ocul. **183**:563-569, July, 1950.

Corneal excision is advised immediately after enucleation in donor eyes. If keratoplasty is to be performed within three hours after enucleation, the excised cornea is preserved in ice. If the interval between enucleation and keratoplasty is greater, the excised cornea is placed in paraffin oil and kept at a temperature of 4 to 6°C. until several hours before keratoplasty. The implant is preferably cut from the posterior side of the excised cornea to reduce trauma of the endothelial layer and Descemet's membrane, as these are replaced slowly. A concave paraffin model of the anterior corneal surface facilitates accuracy in shaping the implant. Based on an extensive experience, the author concludes that enucleated eyes prepared in the usual manner, that is in paraffin oil at 4 to 6°C., tend to develop degenerative changes which reduce transparency and delay healing in the implant.

Chas. A. Bahn.

Gandolfi, C. **Allergic tuberculous conjunctivitis.** Atti d. 37 Congresso Soc. oftal. ital. **10**:442-446, 1948.

About 5 percent of the patients in a sanatorium for tuberculosis show a follicular conjunctivitis, rarely with phlyctenules. It can be assumed that this is an allergic reaction to the proteins of Koch's bacillus. This assumption is based on a positive ophthalmo-reaction, high eosinophil content in the conjunctival secretion, improvement with antihistaminic drops, the formation of follicles and the absence of micro-organisms in the conjunctiva. (References) Frederick C. Blodi.

Giardini, A. **Keratitis pustuliformis profunda (Fuchs) improved with penicillin.** Atti d. 37 Congresso Soc. oftal. ital. **10**: 446, 1948.

Improvement followed massive doses of penicillin, systemically and locally, in a unilateral case of proved luetic origin.

Frederick C. Blodi.

McCulloch, C., and Pashby, T. J. **The significance of conjunctival aneurysms in diabetics.** Brit. J. Ophth. **34**:495-505, Aug., 1950.

Conjunctival aneurysms were found in 55 percent of diabetic and 14 percent of nondiabetic patients, or four times as frequently in diabetics. One type seen is a true berry aneurysm to which a vessel can or cannot be traced. This type may be related to diabetes. The second type appears as an aneurysmal dilation of the veins, found in inflammation and in elderly people. These are common, of doubtful significance and were not included in this survey. Aneurysms were more frequently found in diabetics with retinopathy than in those without retinopathy, and more frequently among the latter than in normal individuals. The presence of aneurysms in the conjunctiva suggests that they occur in most tissues of the body. They have been found in

the kidney where the circulation is similar to that of the middle layers of the retina, but not in other tissues. (9 figures)

Orwyn H. Ellis.

Monciino, N. **The sedimentation rate of red cells in trachoma.** Riv. ital. d. tracoma e di pat. oculare esotica. 1:5-13, Oct.-Dec., 1949.

The sedimentation rate of 60 patients in all stages of trachoma was studied. There was no relation between the rate of sedimentation of the red cells to the trachomatous process. The only change in rate was noticed when a septic process of the eye or orbit, such as dacryocystitis, orbital cellulitis, corneal ulcer or endophthalmitis was superimposed. Francis P. Guida.

Oxilia, E. **Keratitis in psoriasis.** Atti d. 37 Congresso Soc. oftal. ital. **10**:574, 1948.

This keratitis is characterized by vascularized marginal infiltrates and by small avascular central foci. Both lesions may sometimes show a superficial erosion and subepithelial or deep opacities.

Frederick C. Blodi.

Rapisarda, Dante. **Trachomatous heteroallergy.** Riv. ital. d. trachoma e di pat. oculare esotica 1:7-19, July-Sept., 1949.

The author has noted for some time that when an acute inflammation is superimposed on trachoma, follicles often appear, giving a picture which is similar to that of acute trachoma. These follicles, however, will be absorbed without further formation of scar tissue if the acute process subsides. Corneal pannus may also occur. The author calls this process trachomatous heteroallergy.

Francis P. Guida.

Sanna, M. **Herpetic episcleritis.** Boll. d'ocul. **29**:173-177, March, 1950.

Two soldiers, 21 and 22 years old, and serving in the same unit, developed unilateral episcleritis, the etiology of which was ascertained, in one case, by the presence of a dendritic keratitis of the same eye, in the other case by inoculation into a rabbit's cornea. The scleral lesions took about three weeks to heal while the keratitis complicating the disease of one of the patients healed in 13 days. Treatment consisted of the application of penicillin ointment, oral sulphonamide administration, and intravenous cyclotropin injections. (References)

K. W. Ascher.

Saubermann, G. **Conjunctivitis pseudomembranacea chronica granulomatosa (lignosa).** Ophthalmologica **118**:666-686, Oct.-Nov., 1949.

The author reports one case of this apparently very rare disease. Only 10 similar cases have been reported in the entire ophthalmologic literature. The disease occurs only in girls under 11 years of age. The characteristic features of the conjunctivitis are 1. the formation of thick pseudomembranes, 2. a chronic course, 3. granulomatous hypertrophy in the later stages, and 4. corneal involvement. If a hemolytic streptococcus can be grown from the conjunctiva the author recommends treatment with antibiotics, sulfonamides, an autogenous vaccine and frequent irrigations with potassium permanganate. The literature is reviewed in great detail. Peter C. Kronfeld.

Selby, G. D., and Parisi, P. J. **Ocular pemphigus.** Arch. Ophth. **43**:238-243, Feb., 1950.

A typical case of bilateral ocular pemphigus is reported. The course is chronic and progressive and cicatricial changes involve the palpebral and bulbar conjunctiva. An unusual occurrence was the exfoliation of the finger nails with replacement by scarred nails.

John C. Long.

Shafto, C. M. **A simple method of inserting amniotic membrane grafts into the conjunctival sac.** Brit. J. Ophth. **34**: 445-446, July, 1950.

Amniotic membrane grafts are widely used in chemical burns to prevent symblepharon. A simple procedure is described for holding the graft deep within the conjunctival fornix. A double armed suture is placed in the folded graft and brought out in two places through the skin and tied through rubber tubing. The lids are taped together for 48 hours.

Morris Kaplan.

Šimková, Maria. **Treatment of herpetic eye diseases with gynergen and dihydroergotamine.** Ophthalmologica **119**:381-396, June, 1950.

The treatment of the various forms of keratitis due to the herpes simplex virus is discussed. The very voluminous literature, which reveals the limited efficacy of any therapeutic method thus far devised, is reviewed in detail. Following the recommendation of Friis-Moeller and Birkhaeuser, the author used gynergen internally and dihydroergotamine locally in 40 cases of herpetic keratitis. Gynergen was given in amounts varying from 3 to 6 mg. per day. The dihydroergotamine solution (1 mg. in 4 cc. of saline) was placed onto the cornea every two hours. Between these applications the eye was kept patched and under the effect of atropine. In secondary infections penicillin was added to the local regime. Of the 40 patients treated in this manner 23 did well in that the corneal lesions healed within less than 9 days. The result was considered satisfactory in another 13 patients who were cured in 10 to 28 days. Signs of improvement became noticeable a few days after the inception of the treatment. In four cases the author considered the treatment to have been ineffective. In one of these a disciform keratitis was present at the inception of the therapy.

Peter C. Kronfeld.

Sjøgren, Henrik. **Several problems concerning keratoconjunctivitis sicca.** Ann. d'ocul. **183**:500-514, June, 1950.

Dry keratoconjunctivitis is one part of a slowly progressive constitutional degenerative syndrome which essentially involves the mucous membranes of the entire body. The basal membranes undergo thickening with leucocytic infiltration, decreased secretion, filament formation and ultimate disintegration. Vascular irritability is a variable symptom. After the conjunctival instillation of 1 percent Bengal red solution, a characteristic double triangular corneal staining is observed, the bases being at the outer and inner limbus. The filter paper test of Schirmer is not considered reasonably accurate. Other membranes involved include those of the nose, throat, vagina, and joints. Glandular swelling of the lacrimal, salivary, and parotid glands is unusual and serves in the differing of this syndrome from Mickulicz disease and benign lymphogranulomatosis (Besnier-Boeck-Schaumann disease). Middle-aged women are more frequently affected. No treatment can restore the tissue involved. Among the palliative treatments mentioned are solutions of 2 percent sodium salicylate, fibrolysin, sodium chloride, liquid paraffin, and artificial tears. The formula for artificial tears mentioned is: gelatin 0.3, chloretone 0.3, Ringer-Lock solution 30.00. Obliteration of the lacrimal canaliculi surgically or by cauterization is of some permanent value. (56 references)

Chas. A. Bahn.

Sourdille, G. P. **The keratitis of Hutchinson and keratoplasties: perforating or lamellar grafts.** Ann. d'ocul. **183**:495-499, June, 1950.

The author prefers lamellar keratoplasties in the treatment of opacities due to luetic interstitial keratitis. Healing is more rapid, coaptation is more uniform and the visual results are better. Complications such as glaucoma, infection, and vascular infiltration are also less frequent. Pre-existing amblyopia, exanopsia, high myopia, and associated chorioretinitis should be recognized before operation.

Chas. A. Bahn.

Stansbury, F. C. **Corneal transplantation. II. Indications and contraindications.** Arch. Ophth. **43**:337-364, Feb., 1950.

The author concludes a comprehensive statistical study on the present status of corneal transplantation in relation to the preoperative indications and contraindications presented. Conditions generally considered favorable for transplantation are 1. interstitial keratitis, 2. keratoconus, 3. hereditary degenerations of the cornea and 4. small corneal opacities with little or no vascularization. Conditions considered unfavorable for keratoplasty are 1. aphakia, 2. glaucoma, 3. corneal staphyloma, 4. Fuchs's epithelial dystrophy, 5. wide angle synechiae, 6. extensive leukomas with heavy vascularization, and 7. total leukomas with no normal corneal tissue. John C. Long.

Stansbury, F. C. **Lamellar corneal transplantation.** Arch. Ophth. **43**:891-904, May, 1950.

The author discusses the subject in considerable detail and concludes that lamellar corneal transplantation has proved feasible in experimental animals. Successful results with nonpenetrating corneal grafts have been attained in patients. Lamellar keratoplasty is more conservative than penetrating corneal transplantation, in that the former operation is subject to fewer serious complications. Other advantages and disadvantages of lamellar grafts are discussed.

Ralph W. Danielson.

Strazzi, A. **X-ray therapy of the cornea.** Atti d. 37 Congresso Soc. oftal. ital. **10**:578, 1948.

Many corneal diseases, such as interstitial keratitis, hypopyon keratitis, sclerosing keratitis, and phlyctenular and herpetic keratitis, were successfully irradiated at the clinic in Bologna. The factors were: 2 MA, 170 to 180 kv, 0.5 zinc and 3 mm. aluminum filter, 33 cm. skin-target distance, 60 to 80r per session and 5 or 6 sessions at intervals of 5 or 6 days.

Frederick C. Blodi.

Sysi, R. **Xanthoma corneae as hereditary dystrophy.** Brit. J. Ophth. **34**:369-374, June, 1950.

Three siblings and the child of one of them with xanthoma of the center of the corneae are described. The condition was bilateral and generally symmetrical. The disease begins in early childhood, develops slowly, and produces no irritation or corneal blood vessels. Although it is apparently hereditary, a tendency to increased blood cholesterol was present. In one patient a restricted diet was followed by a decrease in the blood cholesterol and the number of corneal crystals and by a clearing of the opacity. The crystals and opacity returned when the blood cholesterol increased. Orwyn H. Ellis.

Winkelman, J. E. **Experimental transplantation of sclera.** Ophthalmologica **119**:336-343, June, 1950.

The author reports the clinical and histologic findings in one rabbit in which a central round disc of the left cornea was replaced by a wellfitting disc of sclera from the right eye of the same animal. The graft took and assumed, to a large extent, the clinical characteristics of normal cornea. The clinical picture suggested that the scleral tissue of the transplant disappeared and was replaced by transparent or semi-transparent corneal tissue. Histologically, the superficial layers of the graft were almost indistinguishable from normal cornea while most of the deeper layers retained a structure characteristic of sclera. In a few places the scleral fibers were fragmented or necrotic. The author could not decide whether the graft was being replaced by adjacent cornea or transformed into such tissue.

Peter C. Kronfeld.

Wolff, Eugene. **The conjunctival naevus and the neurogenic theory of**

melanomata. Tr. Ophth. Soc. U. Kingdom **68**:213-223, 1948.

The author presents two types of objection to Masson's almost universally accepted theory of the neurogenic origin of melanomata, which are based on the structure of the typical conjunctival nerves and on the nature of the sensory end-organs themselves. (7 figures)

Beulah Cushman.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Binkhorst, C. D., Bedaux, L. M. C., Van der Valk, W. G. M., De Haas, P. K., and Brueckner, R. **The association of uveitis with infantile meningo-encephalo-myelitis.** Ophthalmologica **118**:711-721, Oct.-Nov., 1949.

Three cases of a clinically very similar meningo-encephalo-myelitis in infants are reported. All three showed gross uveitis. Histologic examination of the brain in one of the cases revealed the protozoon of toxoplasmosis. Peter C. Kronfeld.

Bottoni, Angelo. **Alterations of the iridocorneal angle in uveitis: gonioscopic observations.** Ann. di ottal. e clin. ocul. **76**: 157-160, May, 1950.

In the various types of uveitis, gonioscopic examination reveals numerous alterations. These, however, cannot be considered pathognomonic signs; in fact, the notable pigmentation of the scleral trabeculum, which is a constant finding in uveitis, is found also in normal eyes and in eyes affected with other diseases. The amplitude of the angle is generally diminished, but in 2 of his 18 cases Bottoni found it increased, as happens even more frequently in glaucoma. An almost constant finding is the presence of numerous peripheral synechiae of various types which are capable of modifying to a notable extent the form of the iridocorneal angle. Harry K. Messenger.

Franceschetti, A., and Babel, J. **Chorioretinitis in sarcoidosis.** Ophthalmologica **118**:701-710, Oct.-Nov., 1949.

In a case of sarcoidosis (verified by skin biopsy) a peculiar form of chorioretinitis, resembling candlewax patches, was observed, in addition to a typical periphlebitis. Histologic examination of the patient's other eye which was in a state of painful atrophy, revealed the typical changes of sarcoidosis.

Peter C. Kronfeld.

Heinsius, Ernst. **Bilateral iridocyclitis complicating serum disease.** Ophthalmologica **119**:149-153, March, 1950.

For the treatment of an acute febrile disease that suggested diphtheria, a 26-year-old woman was given 4,000 units of diphtheria antitoxin in horse serum, whereupon she developed severe back and joint pain and bilateral acute iritis with massive fibrinous exudate. Complete recovery occurred within seven weeks. The etiology of the original disease was not determined. Although there was no history of any previous contact with horse serum, the author attributes the iritis to sensitivity to horse serum and considers it analogous to the acute iritis after repeated injections of horse serum reported by Theodore, Frederick and Lewson (Arch. Ophth. 21:828, 1939).

Peter C. Kronfeld.

Di Marzio, **Roentgentherapy of macular and paramacular choroiditis.** Atti d. 37 Congresso Soc. oftal. ital. **10**:567, 1948.

The author reports on the good results obtained in Bologna. Irradiation will heal the choroiditic lesion when applied during the first two weeks. Frederick C. Blodi.

Matas, B. C. **An unusual case of hemangioma of the choroid.** Ophthalmologica **119**:377-380, June, 1950.

A 15-year-old boy had a retinal detachment due to a well-circumscribed white subretinal cyst which was thought to con-

tain a cysticercus. By surgical exploration a cystlike, smooth-walled round nodule was obtained, the appearance of which was highly suggestive of a cysticercus cyst. The histologic examination of the nodule revealed a hemangioma. The postoperative course and the connections between the choroidal vessels and the hemangioma are not described.

Peter C. Kronfeld.

McCulloch, J. C. **The pathologic findings in two cases of choroideremia.** Tr. Am. Acad. Ophth. pp. 565-572, May-June, 1950.

The primary lesion is apparently a progressive constitutional degeneration of the long posterior ciliary arteries. Because the most advanced pathologic finding was marked arterial sclerosis in the periphery of the choroid, the atrophy of the other choroidal tissues is considered secondary. The pathologic picture differs greatly from that of primary retinal pigmentary degeneration. The histologic changes observed in four eyes of two persons with choroideremia are described in detail. In one eye there was also primary glaucoma which had no apparent relation to the choroideremia. (8 figures)

Chas. A. Bahn.

Melanowski, W. H. **Atropine in the treatment of glaucomatous iridocyclitis.** Tr. Ophth. Soc. U. Kingdom **68**:99-104, 1948.

In six patients with glaucomatous iridocyclitis pilocarpine instillations aggravated the disease. Atropine lessened the inflammatory signs especially if combined with other measures such as leeches, salicylates, sulphonomides, penicillin and repeated punctures of the anterior chamber. Beulah Cushman.

9

GLAUCOMA AND OCULAR TENSION

Barkan, Otto. **Cyclodialysis; its mode of action. Histologic observations in a case of glaucoma in which both eyes were successfully treated by cyclodialysis.** Arch. Ophth. **43**:793-803, May, 1950.

Two eyes, in which the increased ocular tension of chronic glaucoma had been successfully normalized by cyclodialysis, form the basis of this report. In the first eye a free communication from the anterior chamber to the suprachoroidal space was established by cyclodialysis. The author concludes that the beneficial effects of cyclodialysis are due to the formation of such a cleft and gives a twofold argument against atrophy of the ciliary body as a cause of the lowering of the ocular tension. 1. Atrophy of the ciliary body is a gradual process, yet this eye was soft immediately after operation and remained soft for 15 months and 2. clinically, some glaucomatous eyes after years of greatly reduced pressure undergo sudden increases in tension. It is suggested that cyclodialysis is indicated, especially in the late stage of narrow-angle glaucoma in which extensive adhesions have formed in the angle.

E. J. Swets.

Blaxter, P. L. **A note on the so-called enlargement of the blind spot in glaucoma.** Brit. J. Ophth. **34**:442-444, July, 1950.

The arcuate scotoma of Bjerrum is very frequently referred to as an enlargement of the blind spot. In 1931 Traquair insisted that enlargement of the blind spot is applicable in descriptions of papilledema and coloboma but not in glaucoma and furthermore that if small test objects were used it could easily be determined that the arcuate scotoma actually commences away from the blind spot and joins it in progression. In 15 of 35 patients examined with very small objects, it was clearly demonstrated that the earliest defect is a scotoma which appears in the upper temporal field 15° to 25° away from the fixation point and not connected with the blind spot. In no case

was the blind spot found to be enlarged.

Morris Kaplan.

Blum, J. D., and Mutrux, S. **Sturge-Weber's disease.** Ophthalmologica **118**: 781-795, Oct.-Nov., 1949.

The history of Sturge-Weber's disease is reviewed. The typical and "complete" cases are characterized by the triad of hemangioma of the face, glaucoma and contralateral epileptiform attacks (Sturge). Weber's contribution was the recognition of characteristic calcifications of the cerebral cortex. The Danish neurologist Krabbe made another important contribution (Arch. Neurol. and Psychiat. 32: 737, 1934) by clarifying the relationship between the angiomas of the pia and the aplasia of the underlying brain tissue. Thus, the syndrome should carry the names of Sturge, Weber and Krabbe. One typical and one borderline case are described in detail. Peter C. Kronfeld.

Brolin, S. E. **Ocular tension and induced venous pressure in a case of pulmonary tumor.** Acta ophth. **27**:393-402, 1949.

A 72-year-old man with an infiltrating pulmonary tumor had greatly increased venous pressure caused by the compression of the superior vena cava. A marked rise in the ocular tension in the horizontal position, which disappeared when he assumed a vertical position, is attributed to the venous congestion in the uveal vessels. The raised arterial pressure appeared to have no effect on the ocular tension. The mechanism of this process is discussed. (1 roentgenogram, 2 graphs)

Ray K. Daily.

Dellaporta, A. **The effect of peripheral iridectomy on glaucoma secondary to serous iritis.** Acta ophth. **27**:337-348, 1949.

In five cases of secondary glaucoma with very high tension which could not be reduced by conservative therapy, a basal iridectomy reduced the ocular tension. The glaucoma was secondary to luetic iridocyclitis, traumatic iridocyclitis after a perforating injury, heterochromic cyclitis, and tuberculous iridocyclitis. Dellaporta attributes hypertension in these cases to a change in the quality of the albumen in the aqueous, which blocks the spaces of Fontana. Basal iridectomy is the procedure of choice.

Ray K. Daily.

François, Jules. **Gonioscopic studies of glaucomas secondary to uveitis.** Ophthalmologica **119**:44-55, Jan., 1950.

The gonioscopic observations made in 13 cases of uveitis during phases of ocular hypertension are reported in detail. In six of them there were no significant anomalies of the angle. Extensive peripheral anterior synechiae or possible angle-blocking exudates were found in only four cases. In the large majority of glaucomas secondary to uveitis the gonioscopic examination failed to reveal the cause of the hypertension.

The author also reports on the effect of atropine upon the configuration of the angle. In normal eyes as well as in eyes with simple glaucoma the entrance to the angle becomes larger under the effect of atropine. In congestive glaucoma, since the lens occupies a more forward position, the retraction of the iris under the effect of atropine obstructs the angle. The effect of atropine in cases of uveitis with hypertension also depends upon the pre-existing width of the angle. If the entrance to the angle is moderately or very wide, atropine may widen it more, but will not contribute to its closure. If the angle is narrow one should be very suspicious of mydriatics, since a congestive glaucoma may set in at any time.

Peter C. Kronfeld.

Hobbs, H. E. **The trabecula in chronic simple glaucoma, with special reference**

to the gonioscopic appearance of blood in the canal of Schlemm. Brit. J. Ophth. **34**: 489-494, Aug., 1950.

The author describes the variations in the appearance of the trabecula in 40 cases of chronic simple glaucoma. There was no recognizable correlation between the amount of pigment and the severity of the disease. Blood reflux into Schlemm's canal in a high proportion of cases of chronic glaucoma casts doubt on the contention in the literature that obstruction at the canal played an important part in the pathogenesis, nor was opacification of the trabeculum a recognizable factor. Thus the gonioscopic examination provided no conclusive evidence of the pathogenesis of simple glaucoma. Orwyn H. Ellis.

Leydhecker, Wolfgang. **The water-drinking test.** Brit. J. Ophth. **34**:457-479, Aug., 1950.

This work was undertaken to attempt to answer the question whether the water-drinking test is a test for the function of the capillary endothelium, or the osmotic changes of the blood account for the rise of the ocular tension. There were great variations in repeated tests but the two eyes tend to react to the tests similarly. In positive cases (a rise of nine or more millimeters) the ocular tension usually begins to rise 5 to 10 minutes after the start of the drinking and reaches a peak in 20 to 35 minutes. The maximum value is maintained not longer than 10 minutes, then falls to normal or below. Normal eyes have either no rise of tension or less than six millimeters at the same time that glaucomatous eyes have their peak. Positive tests are more frequent with 1,000 cc. than with 500 cc. of water. There was no correlation between the rise in ocular tension and delayed diuresis. A high incidence of insufficient diuresis and a great variability was found in many patients. This points to a systemic disturbance associated with glaucoma but this has not yet been sufficiently studied. A rise of resistance in the conductivity of the serum was larger after the ingestion of a greater volume of water. A close correlation between the resistance curve of the serum and the tension curve of the eye was found and it was concluded that the osmotic changes of the blood cause the rise of the ocular tension in the water-drinking test. Since these changes are the same in the normal and glaucomatous eyes, it must be concluded that there is an obstruction to the outflow of aqueous in glaucomatous eyes. Control tests were made with saline and 50 cc. of water. Patients were selected who had previously had positive tests with 500 cc. of water, and in no case was a rise observed. Since the venous congestion test works by an alteration of the blood volume of the eye, it was concluded after cross testing that the phases brought about by the drinking test have little, if anything, to do with vasomotor alterations of the intraocular vessels. Hence, these tests are fundamentally different. The water-drinking test was found to give approximately the same results in unoperated eyes with chronic simple or with congestive glaucoma. The width of the chamber apparently was not a factor in the test.

Orwyn H. Ellis.

Leydhecker, Wolfgang. **Permeability of the blood-aqueous barrier to fluorescein during the water-drinking test in glaucomatous eyes.** Brit. J. Ophth. **34**: 480-483, Aug., 1950.

In this work the increasing concentration of fluorescein in the aqueous is measured by the decreasing intensity of light required to produce a perceptible color. Whether the flow of water into the eye and the subsequent rise of tension are associated with an abnormally fast inflow was the point of investigation. No

significant difference in the fluorescein curves with or without water ingestion were found in any patient, nor was there any change when 1,000 instead of 500 cc. were taken. The curves were slightly higher in congestive glaucoma than in simple glaucoma, but not significantly so. Thus, the permeability of the blood-aqueous barrier of any one eye to fluorescein did not depend significantly on whether the tension rose after the ingestion of water or not, since water moves in and out of the eye independently of ions of small size. It is therefore not surprising to find that the relatively large ions of fluorescein diffused separately from water.

Orwyn H. Ellis.

Lloyd, J. P. F. **A preliminary survey of 44 consecutive cases of congestive glaucoma.** Tr. Ophth. Soc. U. Kingdom **68**:89-98, 1948.

From approximately 200 glaucoma records the author took every case in which a primary congestive attack was recorded, 48 in number, and among these, 44 patients had none of the features of glaucoma simplex. He was unable to find any instance of a congestive attack in 206 well authenticated and observed eyes which had glaucoma simplex. The incidence of shallow anterior chamber is neither invariable nor conclusively predominant in either type. Damage in glaucoma simplex seems to be localized at or near the disc whereas in congestive glaucoma there is a general depression of peripheral and central function. The author suggests that the main sufferers here are the ganglion cells of the retina.

Chronic congestive glaucoma is identical with a continued attack that goes into absolute glaucoma. The most satisfactory therapeutic results were obtained with iridencleisis. Postoperative miotics led to posterior synechia. Twenty-eight glaucomas remained unilateral for an average of 3.2 years. Damage to central vision was much more a feature of congestive than simple glaucoma. In chronic simple glaucoma the central field seldom shows arcuate scotomata or a nasal step; there is a general depression more suggestive of optic atrophy.

Beulah Cushman.

Matteucci, P. **The carotid sinus reflexes in patients with primary and hemorrhagic glaucoma.** Atti d. 37 Congresso Soc. oftal. ital. **10**:558-559, 1948.

In patients with primary glaucoma the carotid sinus reflex was normal. In hemorrhagic glaucoma, however, the inhibitional reflex on the heart was highly exaggerated.

Frederick C. Blodi.

Matteucci, P. **The neurovascular mechanism of antiglaucomatous operations.** Atti d. 37 Congresso Soc. oftal. ital. **10**: 572-573, 1948.

In animal experiments the author could show that neurovascular lesions of the uvea are usually the real reason for the postoperative hypotony.

Frederick C. Blodi.

Matteucci, P., and Kluzer, G. **The relationship between glaucomatous cupping, ocular hypertension and pressure of the cerebro-spinal fluid.** Atti d. 37 Congresso Soc. oftal. ital. **10**:559, 1948.

In many cases of low tension glaucoma the pressure of the cerebrospinal fluid was comparatively high.

Frederick C. Blodi.

McGuire, W. P. **The management of primary glaucoma.** Virginia M. Mo. **77**: 351-360, July, 1950.

Early, primary simple glaucoma may show no findings between attacks. Careful tension curves, repeated central and peripheral fields, slitlamp and gonioscope examinations are indicated in the study. DFP may precipitate an attack of acute glaucoma which is due to congestion of the ciliary body in the narrow angle types.

During the acute phase, the synergystic action of 1-percent esserine on 5-percent prostigmine with 2-percent pilocarpine, 1.5-percent doryl or 10-percent furmethide may be used every 10 minutes for the first two hours. If the tension is not reduced within 12 hours, surgery should be considered.

In chronic wide angle glaucoma, ½-percent pilocarpine is used if the tension is below 30, and 1-percent pilocarpine if it is above. Surgery is indicated if 2-percent pilocarpine fails to control tension. Dicumarol therapy may prevent progressive field changes after the tension is under control. The various operative procedures are discussed. I. E. Gaynon.

Niedermeier, Siegfried. **Glaucoma and the sympathetic.** Arch. f. Ophth. **150**:385-387, 1950.

The blood adrenaline of normal persons does not differ from that of persons afflicted with glaucoma. Ernst Schmerl.

Purtscher, Ernst. **Antiglaucomatous iridencleisis.** Arch. f. Ophth. **150**:358-373, 1950.

Two hundred seventy cases are surveyed, which were observed for one year or longer. Seventy-eight percent showed satisfactory results with normalization of the ocular tension without medication. Best results were obtained from fistulating cushion-shaped scars. Ernst Schmerl.

Radnót, M., and Csillag, M. **Hormone excretion of glaucomatous patients.** Ophthalmologica **118**:998-1002, Dec., 1949.

The excretion in the urine of the follicular hormone of the ovaries and of the gonadotropic hormone of the pituitary gland was studied in glaucomatous patients with largely negative results.
Peter C. Kronfeld.

Sedan, J., and Sedan-Bauby, S. **Neurological disorders in glaucomatous patients.** Ophthalmologica **118**:534-547, Oct.-Nov., 1949.

The authors review a number of clinical observations of their own (most of them reported previously) which illustrate the complex relationships that exist between the various forms of glaucoma and various neurologic disorders. Some of these disorders, motor and sensory palsies, neuralgias, vertigo, for instance, are considered as "generated" by the glaucoma. The opposite relationship is present in the glaucoma due to strong emotions. The authors describe in detail a case of an athlete (a Rugby champion) who was suffering from prodromal attacks of glaucoma and, by accident, discovered a sure method of terminating the attacks rapidly, namely physical fatigue.
Peter C. Kronfeld.

Sedan, J., and Sedan-Bauby, S. **Tetany and glaucoma.** Atti d. 37 Congresso Soc. oftal. ital. **10**:414-417, 1948.

After reviewing the reports on changes of the ciliary body in severe hypocalcemia, the authors present a case with a suggestive correlation between chronic glaucoma and tetany.
Frederick C. Blodi.

Sourdille, G. P. **The indications and technique of iridencleisis.** Brit. J. Ophth. **34**:435-441, July, 1950.

Despite the controversy over iridencleisis and its dangers, the author feels, after performing 1,100 fistulizing operations that iridencleisis is the procedure of choice in chronic and subacute glaucoma and in hypertensive uveitis. Medical treatment should be tried first but if it fails, the patient should be subjected to surgery without too much delay. The technique of the operation differs from the usual, and strict adherence to this particular technique is urged if the same excellent results are to be obtained. For red eyes, adrenalin, ephedrine and privine

are instilled for a prolonged period and the retrobulbar injection consists of equal parts of 4 percent procaine and ephedrine with a few drops of adrenalin. Hemorrhage is minimized by giving two injections of coagulene and three injections of adrenoxyl. A conjunctival flap is made and brought down over the cornea; then a scleral incision tangent to the limbus is made with a razor blade. This incision is 4 mm. long and 1.5 mm. from the limbus. When the iris root prolapses there is a pause of 30 to 40 seconds to allow the gradual escape of aqueous. The iris sphincter is divided to allow a lip of the iris to rest over the scleral margin. The conjunctiva is sutured and, except in subacute glaucoma, atropine is instilled. Morris Kaplan.

Thomassen, T. L. **The venous pressure in glaucomatous eyes.** Tr. Ophth. Soc. U. Kingdom **68**:75-87, 1948.

The author had previously reported that the height of the venous pressure in the eye was dependent on the bulbar pressure, whether the pressure was in an increasing or decreasing phase. The pressure was measured in an episcleral vein with a water manometer. After examing 30 glaucomatous eyes he concluded that the venous pressure was high compared to the ocular pressure when the ocular pressure was in an increasing phase and low when the ocular pressure was in a decreasing phase. Pilocarpine acted first on the venous pressure, then the bulbar pressure. The changes in the venous pressure seem to alter the possibilities of escape for the aqueous humor. The bulbar pressure will change as the amount of intraocular aqueous humor varies. (6 figures) Beulah Cushman.

Thomassen, T. L. **The safety valve of the eye.** Acta ophth. **27**:413-422, 1949.

In this study the response of the ocular tension to measured pressure was used as the test for the function of Schlemm's canal. In normal eyes compression of 25 grams for two minutes produces a distinct fall in tension. Ten eyes with seclusio pupillae, without acute symptoms, were subjected to this form of compression; three had a normal pressure during the compression, and in seven it increased. On two eyes an iridectomy was done and on two a transfixion. After recovery, compression was followed by the normal fall in ocular tension. These findings indicate the absence of a safety valve in seclusio pupillae, and show that Schlemm's canal acts as the valve in normal eyes. That the drainage behind the iris is not a factor in the compression phenomenon is shown by an eye in which the lens was displaced into the anterior chamber. In it the posterior drainage was obviously free yet the response to compression was that of obstructed drainage. Pressure tests on three eyes with seclusio pupillae also failed to demonstrate a relation between the intraocular and venous tension which was found in simple glaucoma. The data of the investigation and the reported studies in this field justify the assumption that in normal eyes Schlemm's canal acts as a safety valve for rises in intraocular pressure produced by compression, injection or evacuation of liquid, or changes in the quantity of intrabulbar blood, and that in eyes with seclusio pupillae no safety valve of this kind exists. Ray K. Daily.

Thomassen, T. L. **The so-called capsular glaucoma.** Acta ophth. **27**:423-427, 1949.

Exfoliation of the lens capsule was found in 45 of 57 glaucomatous eyes of 39 patients who were examined gonioscopically. In only four were flakes in the chamber angle demonstrated and in none of them enough to obstruct the passage of the aqueous humor. In 12 cases of capsular glaucoma the zonular fibers were visible and in 11 of them the fibers were

distinctly abnormal. In similar studies of 50 eyes with simple glaucoma in London only one case of exfoliation was found.

Ray K. Daily.

Zucchini, R. **The arterial blood pressure in glaucomatous patients after stimulation of vasosensible zones.** Atti d. 37 Congresso Soc. oftal. ital. **10**:579-580, 1948.

To stimulations of the carotid sinus, glaucomatous patients react like patients with general hypertension.

Frederick C. Blodi.

10

CRYSTALLINE LENS

Appelmans, M. **Onchocerca volvulus larvae in the crystalline lens.** Ophthalmologica **118**:733-742, Oct.-Nov., 1949.

The nucleus of the paper is a case report concerning a presumably white woman who, after spending 25 years in the Belgian Congo, returned to Brussels showing the signs of severe ocular onchocercosis. Biomicroscopically larvae of the parasite were identified in the cornea, anterior chamber and in the crystalline lens of both eyes. A biopsy taken from the conjunctiva permitted accurate microscopic study and identification of the parasite. It is possible, though not definitely proven, that the larvae penetrate the lens capsule and remain alive within the lens substance. Peter C. Kronfeld.

De Bernardinis, E. **The peptidasic activity of the normal lens and of the cataractous lens.** Ann. di ottal. e clin. ocul. **76**: 91-98, March, 1950.

De Bernardinis, studying the hydrolytic activity of enzymes that split l-leucyl-glycine and glycyl-l-leucine in normal bovine lenses and in cataractous human lenses, observed that cataractous lenses have an appreciably higher peptidasic activity than normal lenses. As regards the hydrolysis of l-leucyl-glycine, he found that the metallic ions Mn^{++} and Mg^{++} increase the enzymatic activity, Zn^{++} inhibits it, and Co^{++} and Fe^{++} have no effect. As regards the hydrolysis of glycyl-l-leucine, he found that only Co^{++} increases activity, whereas the other metallic ions have no effect. In neither case did he find that the phosphate ions have any inhibitory effect. His studies confirm the hypothesis that in the cataractous lens there is profound alteration in the equilibrium of the protein metabolism.

Harry K. Messenger.

Fedrizzi, G. **The influence of alkaline-earth metals on the development of alimentary tetanic cataracts.** Atti d. 37 Congresso Soc. oftal. ital. **10**:439-441, 1948.

Strontium carbonate in the food prevents the development of tetany cataracts. Barium and magnesium postpone their development. (References)

Frederick C. Blodi.

Fronimopoulos, J., and Joannidis, T. **Bilateral anterior and rudimentary posterior lenticonus.** Arch. Ophth. **43**:864-870, May, 1950.

The authors review the 13 cases reported in the literature and then outline a case of their own. This 25-year-old farmer had had no trouble with vision until the age of 20 years. The corrected vision was about 1/10 in each eye and there was 10D of myopia in the center with emmetropia at the periphery.

Ralph W. Danielson.

Gilbert, W. **Myopia operation.** Klin. Monatsbl. f. Augenh. **116**:349-355, 1950.

The lens was extracted successfully in 60 eyes of 45 patients with high myopia. Complications were 1. hemorrhage in the macula; 2. iridocyclitis; 3. two cases of detached retina, one 15 years and one 18 years after the lens extraction.

Children below the age of 15 years and adults above the age of 35 should be excluded from operation and the myopia

should range between 18 and 26 diopters. Severe macula degeneration is a contraindication for operation. A careful family anamnesis is important; in some families detachment of the retina is common. The capsule should be opened with a needle and no pressure exerted. Two to three weeks later the lens can be extracted. If cortical remnants remain a second discission, followed by extraction of the lens remnants, is indicated. A third operation is necessary very seldom. R. Grunfeld.

Hartmann, Edward. **Vitreous loss during intracapsular cataract extraction.** Ann. d'ocul. **183**:545-562, July, 1950.

The prevention of vitreous loss is essentially the avoidance of its causes. These are classified as primarily due to the patient or to the surgeon. The former includes lenticular and other ocular as well as extraocular conditions which directly or indirectly increase the risks of vitreous loss before, during or after lens extraction. The latter involves the selection of the technique best adapted to the cataract and the surgeon, and the faults in performance. Thus, vitreous loss usually means unjustified risks. The best known operations are described and analyzed. All techniques primarily involve pressure, traction, or both. The first is illustrated by the Smith method, the second by eresiphake techniques and the third by the Kalt method. The author concludes that vitreous loss is potentially minimized by the techniques of Kirby and Rossano. In the latter, the lens is lifted from the hyaloid fossa with non-tooth capsule forceps after the zonular fibers have been ruptured by a slight rotary motion with the forceps. Chas. A. Bahn.

Huerkamp, B. **Drawn-up pupil after congenital cataract operation.** Klin. Monatsbl. f. Augenh. **116**:398-409, 1950.

Drawn-up pupils were noted in one third of extractions of congenital cataract. Vision was not influenced by the displacement of the pupil. Primary discission was followed less often by displacement than lens extraction with iridectomy. In children below the age of 2 years the number of displacements was much greater than in older children. In total cataract the percentage was higher than in partial cataract. The greatest displacement occurred after iris prolapse. Ether narcosis and instillation of atropine after operation had a better preventve effect than corneal suture and the instillation of miotics.

R. Grunfeld.

Jorio, S. **Two cases of syndermatotic cataract.** Atti. d. 37 Congresso Soc. oftal. ital. **10**:569-570, 1948.

Both cases occurred in patients with scleroderma. One patient had also a keratoconjunctivitis sicca. The author assumes an endocrine basis for these cataracts.

Frederick C. Blodi.

Kirby, D. B. **Cataract surgery for one-eyed patients.** Tr. Am. Acad. Ophth. pp. 542-560, May-June, 1950.

The author evaluates the surgical results in his own and certain other large series of monocular cataract. The opinions of prominent American ophthalmic surgeons on the special conditions under which surgery is performed on one-eyed patients are presented. All are agreed that the cause for loss of the first eye, especially if it followed cataract surgery, should be thoroughly understood, and every precaution possible should be taken to prevent the same complications from arising again. The medical and surgical complications leading to loss of the first, and later the second, eye are analyzed. Glaucoma, uveitis, and amblyopia occur most frequently in both cases. There is a close correlation between the causes for loss of the first and second eyes. The prognosis of surgery on the second eye is considerably improved by careful consideration of

the course previously followed. Indications for cataract surgery on the one-eyed are much more clearly defined. The patient should be aware of the hazards accompanying operation, and be willing to accept the added risk. The type of suture and technique of extraction with or without iridectomy are determined by the surgeon's personal preference, and to some extent, by the exigencies of the situation at the time of operation.

Gustav C. Bahn.

Papagno, M. **Pigment deposits behind the lens after contusion of the eyeball.** Boll. d'ocul. **29**:178-185, March, 1950.

A 20-year-old woman was seen two hours after contusion of her eyeball. An abrasion of the cornea interfered with exact examination; 48 hours later, a sickle-shaped retrolental opacity was found parallel to the lens equator between the 5- and 7-o'clock positions. The opacity consisted of brown pigment granules of different size; its convex margin, about 2 mm. from the equator, was sharply outlined while the concave margin appeared indistinct. The nasal end of the opacity was sharply pointed, the temporal extremity showed a small branching towards the equator. The retrolental opacity remained unaltered during four weeks of observation. The author assumed that ciliary pigment was deposited in the retrolental hyaloid-capsular space.

K. W. Ascher.

Pau, Hans. **Contribution to the theory of cataract development.** Arch. f. Ophth. **150**:340-357, 1950.

The author measured and weighed normal and cataractous lenses of 119 human eyes and he found the following average values. In 44 normal eyes the lens nucleus weighed 100 mgr., the cortex 99 mgr.; in 30 nuclear cataracts the nucleus weighed 123 mgr., the cortex 99 mgr.; in 21 senile cataracts the lens nucleus weighed 93 mgr., the cortex 85 mgr.; and in 24 cataracts due to damage of the lens capsule the nucleus weighed 84 mgr., the lens cortex 114 mgr. An analysis of the data clarifies their theoretical significance.

Ernst Schmerl.

Schlosshardt, Hubert. **Clearing of diabetic lens-opacities in advanced age.** Klin. Monatsbl. f. Augenh. **116**:237-246, 1950.

The author describes the case of a 52-year-old man in whom early diabetic lens opacities, vacuoles under the lens capsule, cleared entirely after insulin therapy. At the time the lens opacity cleared, the patient noticed the sudden development of hyperopia and both occurred on the day when the urine became sugar free for the first time. The sudden change to hyperopia is explained as follows. With dehydration salt retention occurs in the body and in the lens. The index of refraction of the lens nucleus increases and myopia develops. After insulin the body and lens take up water, the refractive index of the lens nucleus diminishes and hyperopia develops. That dehydration causes lens opacities is seen in diabetic coma. In coma extreme dehydration occurs with the development of fine dust-like opacities under the lens capsule which clear as soon as copious intravenous fluid is administered. Transitory lens opacities are more common than is generally accepted. In the beginning these opacities are reversible and only when they last longer do irreparable changes occur.

R. Grunfeld.

Seidenari, R. **Pathogenesis of secondary cataracts.** Atti. d. 37 Congresso Soc. oftal. ital. **10**:577-578, 1948.

In cataractous lenses the epithelium proliferates toward the posterior pole and it is the posterior capsule, not the equatorial region, which gives rise to the formation of new lens fibers.

Frederick C. Blodi.

11

RETINA AND VITREOUS

Arruga, H. **Some conclusions based on two thousand cases of retinal detachment.** Ophthalmologica **118**:655-659, Oct.-Nov., 1949.

The first aid in suspected or diagnosed retinal detachments should consist of a binocular dressing. Retraction of the retina is the principal factor in the mechanism of the detachment. The prognostically important factors are extent and duration of the detachment, size of the tears, improvement following bedrest and the general condition of the patient. A detachment with one small tear and a duration of two months is easier to cure than another detachment with a giant tear and a duration of only one week. Detachments due to disinsertions do not improve much on bedrest. In such cases the barrage should be placed a considerable distance back of the disinserted retinal edge, in a zone where the retina is fairly close to the choroid.

In the treatment of ordinary tears, the applications of the high frequency current should be made sparingly and be placed accurately, under constant ophthalmoscopic control. Flat detachments do not require any drainage. For detachments which are flat at the site of the tear (above), but markedly elevated below, Arruga recommends one small puncture in the latter region. In detachments with marked elevation in the region of the tear he also makes one small puncture and injects air into the vitreous. Vortex veins must be avoided with the utmost care. The period of postoperative bedrest and binocular dressings depends upon the severity of the case.

Peter C. Kronfeld.

Bechgaard, P., Porsaa, K., and Vogelius, H. **Ophthalmological investigations of 500 persons with hypertension of long duration.** Brit. J. Ophth. **34**:409-424, July, 1950.

In this study 485 patients who had had severe hypertension for 4 to 11 years were ophthalmologically examined. The veins were found to exhibit little or no change. Arterial diameters were normal in 50 percent. The arteries were narrow in 34 percent and irregular in caliber in 27. Arteriovenous crossings were normal in 63 percent and in only 1 percent was real compression present. The course of the arteries was normal in 72 percent and the arterial reflex was normal in 54 percent. Copper-wire arteries and sheathing were found in over 4 percent; there were no silver-wire arteries. Severe changes without retinopathy appeared in only 13 percent and only 7 percent of the patients had a retinopathy. The study suggests that pathologic changes in vessels in hypertension is of much less importance than is generally believed. There was little correlation between the changes in the retina and the clinical condition. In 160 of the patients the retinal vessels were entirely normal.

Morris Kaplan.

Bonavolontà, A. **A case of traumatic detachment of the retina and glaucoma, operated upon successfully.** Ann. di ottal. e clin. ocul. **76**:77-86, March, 1950.

Bonavolontà presents a case of a 16-year-old boy whose left eye, which had suffered a severe blow 15 months previously, was found to have a large detachment of the retina and a Shiøtz tension of 45. There was a tear involving a fourth of the circumference of the retina at the extreme periphery, and the disc showed slight glaucomatous excavation. Because of the corneal edema, which would have interfered with observation of the fundus during the operation for the detachment, a cyclodialysis was first done, and three weeks later, when the tension was normal and the cornea was clear, a diathermocoagulation was done according to Weve's technique. The immediate results were excellent, and a year later the

retina was still in place and the tension remained normal. The pathogenesis of traumatic retinal detachment and glaucoma are discussed in the light of the literature, and Bonavolontà's conclusion is that the traumatic glaucoma in this and similar cases is consequent on local neurovascular changes. Harry K. Messenger.

Bourquin, J., and Bourquin, J. B. **Gyrate atrophy of the retina in a family affected with retinitis pigmentosa.** Ophthalmologica **118**:848-857, Oct.-Nov., 1949.

A case of unilateral gyrate atrophy of the choroid and retina is described in a 15-year-old boy in whose family four members are known to have pigmentary degeneration of the retina. The author stresses the fact that gyrate atrophy, in contradistinction to pigmentary retinal degeneration, is not associated with neurologic disturbances.

Peter C. Kronfeld.

Brand, I. **A rare change in the retina in Laurence-Biedl syndrome.** Klin. Monatsbl. f. Augenh. **116**:337-339, 1950.

The author describes a peculiar appearance of the retina in a case of Laurence-Biedl-Moon-Bardet syndrome. In both fundi there was a fine, diffuse pigment disturbance of the retina. An extensive grayish-white degenerative area occupied the whole temporal and upper peripheral portion of the retina but was sharply delimited toward the center. The vessels in the degenerative area had the appearance of red streaks surrounded by intact retinal areas. There were small scattered islands of normal retina. The papillae were somewhat pale, the maculae were normal.

R. Grunfeld.

Cosmettatos, G. F. **Some considerations concerning retinal detachments.** Ophthalmologica **118**:651-654, Oct.-Nov., 1949.

A series of 340 patients with retinal detachment operated upon at the University Eye Clinic of Athens forms the basis of this report. The author believes that there are retinal detachments without tears due to retroretinal transudates produced by the pigment epithelium. In the rare cases of retinal tears without detachment chorioretinitic adhesions prevent the detachment. For the localization of the tear during the operation the author uses a modification of the ophthalmoscopic method of Weve and Lindner. A small change in the optics of the ophthalmoscope makes the light spot on the sclera sharper and brighter.

In 70 percent of the patients complete anatomical reattachment was obtained. Failures could be attributed to long duration of the detachment, restlessness of the patient, diffuse retinal degeneration with new tears in unoperated areas and to surgical aphakia. Peter C. Kronfeld.

Dekking, H. M. **Pigmentary degeneration of the retina after quinine intoxication.** Ophthalmologica **118**:743-745, Oct.-Nov., 1949.

A Dutch girl living in Batavia developed malaria at the age of nine months. Quinine therapy was instituted by a physician well versed in the treatment of malaria. Two days later the vision suddenly became very poor. Although the administration of quinine was stopped immediately, the vision did not return. Eleven years later the child was seen by the author and found to have a visual acuity of 1/60, fields of 5 degree radius, chalky-white discs, almost invisible retinal vessels and a broad peripheral zone of bone-corpuscle-like pigment masses in the fundus of each eye. "It seems curious that two such widely differing diseases as primary pigmentary degeneration of the retina and quinine intoxication can have so much in common."

Peter C. Kronfeld.

Fortunato, F. **Spontaneous healing of retinal detachment.** Atti d. 37 Congresso Soc. oftal. ital. **10**:568, 1948.

Six cases of retinal detachment with

holes and of one retinal hole without a detachment, which all healed spontaneously, are reported. Frederick C. Blodi.

François, J. **Prepapillary cyst developed from remnants of the hyaloid artery.** Brit. J. Ophth. **34**:365-368, June, 1950.

An unusual cyst adherent to the optic disc is described. The condition has remained unchanged during the six years it has been observed. Some small, recurrent, transient hemorrhages have been seen in the surrounding retina and ascribed to the irritation brought on by the movements of the cyst. Reported similar cases are summarized and the developmental anatomy of the region of the disc is reviewed. Orwyn H. Ellis.

Funder, Wolfgang. **Structure of the body in retinal detachment.** Klin. Monatsbl. f. Augenh. **116**:340-348, 1950.

Primary retinal detachment may have some relation to leptosome body structure. Among 100 men with 106 eyes with detached retinas 68 had signs of leptosome body structure. Among asthenics tuberculous infection is common. Peripheral tuberculous chorioretinitis and synechia may become the forerunners of retinal detachment. R. Grunfeld.

Givner, I., and Jaffe, N. **Occlusion of the central retinal artery following anesthesia.** Arch. Ophth. **43**:197-201, Feb., 1950.

This is a preliminary study with a report of four cases of occlusion of the central retinal artery after general anesthesia. A combination of the following factors seems to be needed to produce the occlusion: 1. loss of blood or shock; 2. pressure on the eye in a patient with a low nasal bridge and 3. prolonged anesthesia.

John C. Long.

Grignolo, Antonio. **Bilateral malformation of the retina and its veins.** Ophthalmologica **119**:129-136, March, 1950.

In a nine-year-old boy with esotropia of the right eye, ophthalmoscopic examination revealed a bilateral symmetrical anomaly of a large inferotemporal retinal vein which for a good portion of its course rose out of the level of the retina into the vitreous. Most of the feeding venules were in the level of the retina and so was its most proximal portion near the disc. The intravitreal portion was surrounded and connected with the retina proper by a lacy white tissue. In the esotropic eye this anomaly was more pronounced and the visual acuity very much lower than in the fixing eye. The author compares the case with other congenital vascular malformations of the retina and discusses the various genetic possibilities.

Peter C. Kronfeld.

Heuscher-Isler, R., Gysin, W., and Hegner, H. **A pedigree showing dominant transmission of retinitis pigmentosa.** Ophthalmologica **118**:858-865, Oct.-Nov., 1949.

Members of three generations of a retinitis pigmentosa-family could be examined. The ratio of affected to unaffected members was 11 to 10. Unaffected parents had unaffected children and vice versa. Peter C. Kronfeld.

Leffertstra, L. J. **Anterior disinsertions of the retina.** Ophthalmologica **119**:1-16, Jan., 1950.

In this study of 200 cases of anterior retinal disinsertion in the eye clinic of the University of Utrecht between 1930 and 1944 it was found that unlike the behavior of the senile-myopic detachment with its alarming symptoms, the onset and the progression of the detachment caused by oral tears is slow and in the great majority of cases remains unnoticed by the patient until the fovea is reached. This treacherous course is largely responsible for the slight functional improvement so often met with after a complete anatomical cure of the detachment. Connected with the slow progression is a peculiar

tendency toward the formation of demarcation lines. Because of a history and signs of a severe direct injury 42 of the cases were considered to be of traumatic origin. In 36 percent of them the disinsertion was located above, and in 64 percent below the horizontal meridian. In the non-traumatic cases the disinsertion was most commonly located in the inferotemporal quadrants. Cysts not lying in the posterior (central) edge of the tear form, as a rule, after the onset of the detachment. Cysts lying in the central edge of the tear may form after the onset of the detachment, but more often precede, that is, are pre-existent to the detachment.

The treatment consisted of diathermic surface coagulation of the sclera describing an arch parallel to the central edge of the tear, followed by one or more punctures over the posterior edge of the disinsertion. Complete anatomical reattachment occurred in 95 percent of all operated eyes. The functional results were closely related to the duration of the detachment. Follow-up examinations revealed, in a number of successfully operated eyes, further functional decline associated with an ophthalmoscopic appearance resembling primary pigmentary degeneration. "Only cases with a duration of the detachment of three months or longer showed this peculiar and disappointing late loss of function."

Peter C. Kronfeld.

Longhena, L. **The etiology of retinal detachment.** Atti d. 37 Congresso Soc. oftal. ital. **10**:571, 1948.

Retinal detachment is thought to be a complication of a low grade uveitis. This inflammation always precedes the detachment and may also affect the other eye. The uveitis is probably of a tuberculous origin. Frederick C. Blodi.

Maeder, G. **Retinitis pigmentosa following virus diseases.** Ophthalmologica **118**:746-750, Oct.-Nov., 1949.

Maeder reports a case of sudden bilateral visual impairment in a white man, aged 41 years, occurring on the tenth day of an acute febrile disease of the general character of an encephalitis. The central vision was reduced to 20/200 with moderately contracted fields and normal eyegrounds. During the following two years the function of both eyes fluctuated around the 20/200 level. No tangible ophthalmoscopic signs of disease occurred until three years after the onset when the diagnosis of retinitis pigmentosa of the postinflammatory, virus disease type, was made. Peter C. Kronfeld.

Nagy, F. **Changes in the fundus caused by polycythaemia.** Brit. J. Ophth. **34**:380-384, June, 1950.

The visual disturbances which often accompany polycythemia vera are ascribed to the arteriolar changes in the fundus. Two cases are reported in which spasm in the central retinal artery and recovery were observed. A third patient with partial dilatation of the retinal vein is described. Orwyn H. Ellis.

Radnót, M., and Sipos, I. **The treatment of diabetic retinopathy.** Ophthalmologica **119**:373-377, June, 1950.

For the treatment of diabetic retinopathy, the authors have used a preparation called vitaplex P, the active principle of which apparently is rutin. In cases showing hemorrhages and neovascularization strikingly good results were obtained, while cases with hemorrhages and degenerative lesions remained unchanged. The paper contains no statement indicating that any of the patients were observed for more than just a few months.

Peter C. Kronfeld.

Rados, Andrew. **Hemangioblastoma of the retina (Von Hippel-Lindau disease). Concluded.** Arch. Ophth. **43**:265-329, Feb., 1950.

Rados concludes this very detailed

monograph on hemangioblastoma by discussing the pathoanatomic observations, the correlation of retinal and brain lesions, the genetic background and the problems in differential diagnosis. John C. Long.

Renard, G., and Dhermy, P. **Considerations on the pathogenesis of diabetic retinopathy.** Arch. d'opht. **10**:170-186, 1950.

The authors discuss the various theories of the pathogenesis of diabetic retinopathy and conclude that the theory which attributes the changes to an associated renal complication is not tenable in view of their clinical and laboratory findings of normal renal function in the majority of their diabetics with retinopathy. They also discard the theory that the retinopathy is due to hypertension in view of the frequency of retinopathy in diabetics without hypertension and the low incidence of retinopathy in hypertensive diabetics. They stress the importance of the venous changes in the diabetic fundus and the hemorrhagic aspect of the lesions which leads to the complications of vitreous hemorrhage, retinitis proliferans, and hemorrhagic glaucoma. They emphasize the lipoidal character of the degenerative changes in the vessel walls and the high cholesterol blood level in diabetics with retinopathy. They mention the aneurysmal dilations described by Ballantyne and Loewenstein, which depend on ectasia of the vessel walls, and conclude that the retinopathy of diabetes which differs notably from the retinopathy of Bright's disease and hypertension, can be explained on the basis of the special type of degeneration which affects the vessel walls in diabetes.

In a study of 40 cases of diabetic retinopathy the authors noted that 25 percent of their cases were in young diabetics whose lives had been prolonged by insulin therapy but who had not been protected by this therapy against vessel changes. They further noted that insulin was of no value in the treatment of the retinopathy, and that the retinopathy was not dependent upon glycosuria since in 18 cases, or 45 percent of their series, the retinopathy occurred in the absence of glycosuria. In fact, the retinopathy usually followed a disappearance of glycosuria which seemed to occur independently of the blood glucose level. They attribute the vessel changes in diabetes to absence of a lipotropic factor of pancreatic origin, a factor known to exist as a result of the experimental work of Dragstedt in 1936. The authors conclude that insulin deficiency is therefore not the sole cause of diabetes and report a series of clinical studies favoring the hypothesis that diabetic retinopathy is due to a disturbed lipoid metabolism.

Phillips Thygeson.

Shapland, C. D. **Prognosis in detachment of the retina.** Tr. Ophth. Soc. U. Kingdom **68**:115-136, 1948.

The author presents his experience with operative treatment of detachment of the retina at Moorfields since Gonin presented his treatment and with the modification adopted since 1929. Of 204 patients with retinal holes who were operated upon by cautery puncture 30 percent were cured. Of 131 patients in whom diathermy was used 46 percent of those were cured in whom retinal holes were discovered before the operation. Inferior detachments tend to occur in early life. The eyes are not myopic and in about one third there is history of trauma. Superior detachments tend to occur in later life, typically in myopic eyes. Preoperative control of posture treatment may be of great help. Myopic detachments associated with giant dialysis and patients with aphakia in which a tear cannot be found have a very bad prognosis. Beulah Cushman.

Sobanski, Janusz. **Treatment of thrombosis of the central retinal vein.** Klinika Oczna **18**:476-482, 1948.

The mechanism of blood clotting is re-

viewed in its relation to thrombosis in the central retinal vein. Use of vetren, heparin and dicoumarin in venous thrombosis is discussed. Heparin is nontoxic, but it is eliminated very fast and is very expensive. Vetren is weaker than heparin. Dicoumarin is the drug of choice. It slows down formation of prothrombin by the liver. Control of blood clotting time in treatment with dicoumarin is stressed. A case of central vein thrombosis is described. The result of treatment with dicoumarin was very satisfactory.

Sylvan Brandon.

Tavolara, L. **Quadrant retinitis pigmentosa in a patient with incomplete Laurence-Moon-Biedl syndrome.** Atti d. 37 Congresso Soc. oftal. ital. **10**:477-480, 1948.

In this patient, only one quadrant in each retina was affected.

Frederick C. Blodi.

Tirelli, G. **A macular hole caused by rapid depression of the atmospheric pressure.** Atti d. 37 Congresso Soc. oftal. ital. **10**:561, 1948.

Climbing a 12,000-foot mountain during sudden bad weather a 30-year-old man had bilateral epistaxis and poor vision in the left eye. The examination two days later revealed a large macular hemorrhage and two months later a macular hole had developed. Frederick C. Blodi.

Topolski, Stanislaw. **Angiomatosis of the retina.** Klinika Oczna **18**:493-510, 1948.

The patient, 20 years old, had had diabetes since the age of three years and had been under observation for Hippel-Lindau disease for about a year. X-ray treatment was used and a considerable decrease of caliber of the vessels was achieved. After a minor accident new hemorrhages appeared and acute glaucoma developed. Several operations were performed with no benefit and the patient died from a hypoglycemic shock. The author points out the relationship to the phakomatoses of van der Hoeve and the syndromes of Crouzon, Christophe and Gaucher, Sturge Weber, and Osler Rendu. Sylvan Brandon.

Vogelius, H., and Bechgaard, P. **The ophthalmoscopical appearance of the fundus oculi in elderly persons with arterio-sclerosis and normal blood pressures.** Brit. J. Ophth. **34**: 404-408, July, 1950.

There has been considerable uncertainty and confusion about fundus changes due to arteriosclerosis and those due to hypertension. Nowhere has there appeared the description of a study of subjects having sclerosis but no hypertension. In this report the results of careful fundoscopy on 124 subjects are described. They were inmates of an old people's home, all of whom were over 65 years of age and had clinical arteriosclerosis but normal blood pressures on successive readings. Irregularities in arterial caliber and an abnormal arterial reflex occurred in almost every subject. Tortuosity of vessels and venous compression were seen in only three. Most interesting of the findings was the fact that the veins remained quite normal and hemorrhages, exudates, thrombosis and papilledema were entirely absent.

Morris Kaplan.

Weve, H. **Shortening of the globe by reefing the sclera.** Ophthalmologica **118**: 660-665, Oct.-Nov., 1949.

Lindner had the fortunate idea of shortening the eyeball wall in certain types of retinal detachment, specifically those with shrinking, retracting retina or vitreous. To shorten the eyeball wall Lindner recommends and practices L. Mueller's sclerectomy which can only be used in cases without firm adhesions between choroid and sclera. Weve describes a method of eyeball shortening which consists of folding or reefing the sclera by

means of a running catgut suture placed so as to close an imaginary sclerectomy. To produce the usual meridional shortening all scleral bites are placed in equatorial direction, one in front and one behind the imaginary sclerectomy. When such a suture is pulled up the sclera forms a slight fold protruding inward and the eyeball is shortened. A nonabsorbable, chemically inert, very strong suture material of the name Supermit obtainable from Wall in Heidelberg, Germany, has proved very suitable for this operation. Weve's experience with the new operation is sufficient to recommend it as an effective and harmless procedure.

Peter C. Kronfeld.

Wilczek, Marian. **Clinical pictures of traction on the optic disc.** Klinika Oczna **18**:464-475, 1948.

Seven cases of a deformity are presented in which fibrous tissue folds are attached to the discs and to the periphery of the retina. The pull of this tissue distorts the optic discs and displaces the blood vessels. The retina may be elevated into a fold forming the falciform detachment of Weve. A drawing of each fundus is presented. Retinitis proliferans is the most frequent cause of this condition for which the author suggests the term of "protractio papillae nervi optici."

Sylvan Brandon.

Wilkowa, Maria. **A case of partial thrombosis of the central retinal vein treated by dicoumarin.** Klinika Oczna **18**: 432-436, 1948.

General treatment was unsuccessful and treatment by dicoumarin for one month brought considerable objective and subjective improvement in a case of thrombosis of the lower temporal veins of the right eye. The treatment was interrupted because of bleeding from the kidneys and mucous membranes.

Sylvan Brandon.

Zeppa, Rosario. **The ocular tension in detachment of the retina.** Ann. di ottal. e clin. ocul. **76**:144-156, May, 1950.

In idiopathic detachment of the retina the tension is often low, sometimes normal, and in certain cases elevated. After operation the tension is low in unsuccessful cases, whereas in successful cases it is usually normal. Hence postoperative hypotony is a bad prognostic sign. In the absence of other explanatory factors the hypotony is probably due to chemical changes in the subretinal fluid. Eyes with detached retina, both before and after operation and regardless of outcome, show the same diurnal variation in tension as normal eyes, and the higher the tension the greater the range. These variations are probably due to the same causes that bring about the diurnal cycle in temperature, glycemia, nitrogen, water, and calcium. (References)

Harry K. Messenger.

12

OPTIC NERVE AND CHIASM

Cross, A. G. **The papilloedema of toxic hydrocephalus.** Tr. Ophth. Soc. U. Kingdom **68**:181-186, 1948.

Otitic or toxic hydrocephalus was first described by Passot in 1912. Symonds pointed out that its essential manifestation are increased intracranial pressure, headache, vomiting and papilledema. He believed that the condition follows otitis media, that there is no abscess formation and that recovery is spontaneous, and produces evidence that it is due to a thrombophlebitis of the superior sagittal sinus of the dura mater. The latter is frequently the result of infection from the lateral sinus, and prevents the absorption of cerebrospinal fluid through the arachnoid villi.

In 32 patients the syndrome was characterized by rise of intracranial pressure, usually in young persons. An infection

somewhere in the body and commonly in the ear or nasopharynx preceded its onset, occasionally a paresis of one or both sixth cranial nerves was present in the early stages, but this is not permanent. Many patients showed a rise of the cell count of the cerebrospinal fluid and papilledema of prolonged duration without permanent visual defect. Optic atrophy characterized by loss of peripheral field, usually on the nasal side, tends to occur with prolonged papilledema, but was found in only one case of this series. Twelve patients had papilledema for about four months, and one for nine. Those patients who had an arcuate scotoma had had papilledema for rather longer periods. There was an enlargement of the blind area in all these patients, but the changes disappeared when the swelling subsided. The arcuate scotoma is probably the result of vascular obstruction in the optic nerve due to absolute or relative rise of intraocular pressure. Beulah Cushman.

De Grósz, S. **Retrobulbar neuritis due to malnutrition.** Ophthalmologica **118**: 764-774, Oct.-Nov., 1949.

The author had an opportunity to study closely eight men with a nutritional amblyopia without neurologic signs which occurred in adults after the siege of Budapest. Thiamine tolerance tests suggested the presence of thiamine deficiency. Low protein intake seemed to be another important factor in causing the disease which most probably primarily attacks the ganglion cells of the retina and only secondarily involves the papillomacular bundle. Specific vitamin therapy was of slight value. Peter C. Kronfeld.

Hambresin, L., and Schepens, C. L. **The relationship between tobacco amblyopia and heredo-familial optic atrophy.** Ophthalmologica **118**:751-763, Oct.-Nov., 1949.

Tobacco amblyopia is a well-defined disease, characterized perimetrically by bilateral centrocecal scotomas. The authors report cases of heredofamilial optic atrophy (Leber's disease) whose visual field defects closely resembled those of tobacco amblyopia. A partly toxic etiology of Leber's disease is suggested.

Peter C. Kronfeld.

Di Luca, G. **Optic atrophy after quinine and methyl alcohol.** Atti d. 37 Congresso Soc. oftal. ital. **10**:575-576, 1948.

The author concludes that quinine primarily attacks the arteries, whereas methyl alcohol causes an optic neuritis, especially of the papillo-macular bundle.

Ferderick C. Blodi.

Morone, G. **Unilateral plerocephalic papilledema.** Atti d. 37 Congresso Soc. oftal. ital. **10**:559, 1948.

To the well-known causes for a unilateral papilledema with increased intracerebral pressure the author adds high unilateral myopia which in his case prevented the formation of an edema of the nervehead. Frederick C. Blodi.

Poos, F. **The problem of retrobulbar neuritis. Retinogenic recurring central scotoma as a consequence of reversible circulatory disturbances.** Klin. Monatsbl. f. Augenh. **116**:159-174, 1950.

The author questions the theory that retrobulbar neuritis is caused by toxic products with selective affinity for the papillomacular bundle. If nerve fibers were affected the visual field should show nerve-fiber defects and peripheral scotomas. It is inconceivable that a toxin should always affect an equal number and symmetrically situated nerve fibers to produce a central scotoma that always grows symmetrically to the periphery. Only a dynamic circulatory disturbance can be the cause of the symmetrical contraction. Central scotoma is attributed by the author to a stagnation in the venous circulation. An increased extraocular

pressure caused by an increased tonus in the muscular cone hinders the outflow of the venous blood and the resorption of the serous fluid. The stagnant fluid with the accumulated waste products has a deleterious action upon the tissues which depend on it for nutrition. The choroidal blood circulation is first affected and since the nourishment of the fovea and macula is primarily dependent on the choroidal circulation they will be affected first and the scotoma will extend radially to the periphery. When the muscle tonus relaxes the venous circulation reestablishes itself and the patient regains his vision. The extraocular muscles have pharmacologic peculiarities. They are directly contractible to nicotine and cholinergic drugs. It is plausible to assume that in diabetes, sinus diseases, and in other disease which cause central scotoma, the blood contains an increased amount of cholinergic substances which diffuse and act directly on the muscle cone. R. Grunfeld.

Schmid, A. E. **Epipapillary membrane.** Ophthalmologica **118**:843-847, Oct.-Nov., 1949.

Epipapillary membranes may be remnants of normal embryologic tissues or of exudates due to prenatal or postnatal inflammatory processes. Epipapillary membranes are hardly ever related to Buerger's disease. Peter C. Kronfeld.

Wessely, E., and Guist, G. **The treatment of retrobulbar neuritis and its rhinogenic origin.** Klin. Monatsbl. f. Augenh. **116**:175-184, 1950.

The return of vision after radical sphenoid or ethmoid sinus operations in four cases of retrobulbar neuritis was so prompt that the rhinogenic etiology of retrobulbar neuritis cannot be doubted. The inflammation of the optic nerve is a secondary infection carried into the nerve either by the blood or by direct extension. The inflammation extends along the arteries and the nerve canals into the orbit and thence to the nerve. Cocain and adrenalin on the nasal mucosa probably act by reducing the collateral edema. The authors found that patients with retrobulbar neuritis whose vision improved after the use of adrenalin-cocain regained their vision promptly after sinus operation; those patients who did not, had a poor prognosis. R. Grunfeld.

Ophthalmic Miniature

Out of the ninety-two foreign associates of the French Academy, no less than ten were descended from religious refugees, usually in the third or fourth generation. Switzerland had eight out of the ten, and we thence easily gather how enormously she is indebted to the infusion of immigrant blood. Similarly, the only two American associates—Franklin and Rumford—were descended from Puritans.

A. de Candolle, *Histoire des Sciences*, 1873.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
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News items should reach the editor by the 12th of the month but, to receive adequate publicity, notices of postgraduate courses, meetings, and so forth should be received by the editor at least three months before the date of occurrence.

DEATHS

Dr. Ephraim Kirkpatrick Findlay, Chicago, died September 27, 1950, aged 80 years.

Dr. Charles Fawcett Kutscher, Pittsburgh, died recently at the age of 50 years.

ANNOUNCEMENTS

FLORIDA SEMINAR

Among the ophthalmologists who will lecture at the fifth annual University of Florida Midwinter Seminar in Ophthalmology and Otolaryngology to be held at Miami Beach, January 15 through 20, 1951, are: Dr. Conrad Berens, New York; Dr. Ramón Castroviejo, New York; Dr. Jack S. Guyton, Baltimore; Dr. Harold G. Scheie, Philadelphia, and Dr. Edmund B. Spaeth, Philadelphia.

The lectures on ophthalmology will be presented on January 18th, 19th, and 20th; those on otolaryngology will be given during the first three days of the seminar.

On Wednesday evening, January 17th, all registrants are invited to attend the midwinter convention of the Florida Society of Ophthalmology and Otolaryngology.

Registration fee for the seminar is $40.00. The Division of Ophthalmology is represented by: Dr. Shaler Richardson, Jacksonville; Dr. Nelson M. Black, Miami; Dr. Charles Boyd, Jacksonville; and Dr. Bascom Palmer, Miami. Further information may be obtained from Dr. Walter T. Hotchkiss, 541 Lincoln Road, Miami Beach, Florida.

EAST-CENTRAL RESEARCH SECTION

The East-Central section of the Association for Research in Ophthalmology will meet at the Netherland Plaza Hotel, Cincinnati, Ohio, on January 4, 1951, beginning at 9 a.m. There will be 10 contributions for the program. The guest speaker will be Dr. Albert Sabin, professor of research pediatrics, University of Cincinnati Medical School, whose subject will be "The Eye and I, a microbiologist's use of the eye in research." Those interested are cordially invited to attend.

CHICAGO CLINICAL CONFERENCE

The Chicago Ophthalmological Society will hold its third clinical conference at the Edgewater Beach Hotel, Chicago, on February 15, 16, and 17, 1951. Surgical clinics will be given at several Chicago hospitals the first day, followed by lectures, round-table discussions, and symposia the second and third days.

On Saturday evening the seventh annual Sanford R. Gifford Lecture will be delivered by Dr. Alan C. Woods, Baltimore, whose subject will be "The present status of the adreno-cortical hormone in ophthalmology."

For reservations or further information, write Miss Maud Fairbairn, 8 West Oak Street, Chicago 10, Illinois.

SOCIETIES

INTERPROFESSIONAL COMMITTEE

The National Interprofessional Committee on Eye Care, a group, comprised of representatives of the various societies in the fields of ophthalmology, optometry, and opticianry, recently organized to consider methods of improving the eye care supplied to the public and interprofessional relations, held its first meeting in Chicago.

Avery D. Prangen, M.D., ophthalmologist, Mayo Clinic, Rochester, Minnesota, was chosen chairman for the coming year, and Leslie Myers, chairman of the board, Benson Optical Company, Minneapolis, vice-chairman. Elected Secretary was Carel C. Koch, O.D., Editor, American Journal of Optometry and Secretary of the American Academy of Optometry.

Other members of the committee are: Henry B. Carpenter, guild optician, Syracuse, New York; Frederick C. Cordes, M.D., professor of ophthalmology, University of California, San Francisco; Arthur M. Culler, M.D., professor of ophthalmology, Ohio State University, Columbus, Ohio; H. Ward Ewalt, Jr., O.D., optometrist, Pittsburgh; Franklin M. Foote, M.D., executive director, National Society for the Prevention of Blindness, New York; Henry A. Imus, Ph.D., physicist, Office of Naval Research, Washington, D.C.; Norman A. MacLeod, wholesale optician, Providence, Rhode Island; Glenn H. Moore, O.D., optometrist, Chicago; William F. Hughes, Jr., M.D., professor of ophthalmology, University of Illinois, Chicago.

Problems discussed at this first session included organization, interprofessional relationships, and various other topics relating to improving the optical eye care offered to the public by the several groups comprising the committee. In general, the public health aspects of optical eye care were stressed.

The second meeting of the National Interprofessional Committee on Eye Care will be held concurrently with the annual meeting of the American Academy of Optometry in Chicago, December 17th.

It is learned that the resolutions by the Florida Society of Ophthalmology and Otolaryngology, published on page 1324 of this volume of the JOURNAL, were not officially adopted but were tabled by the society. The JOURNAL regrets its part in the error.

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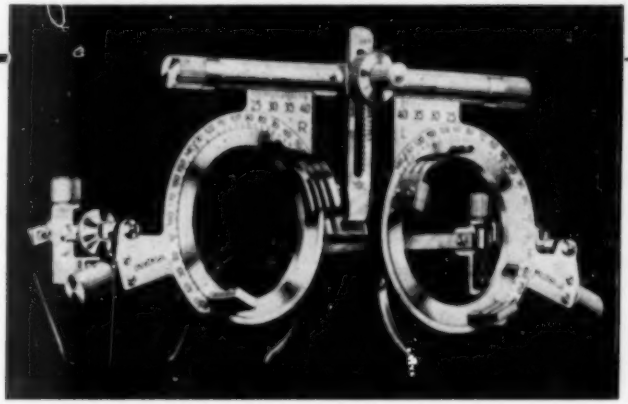

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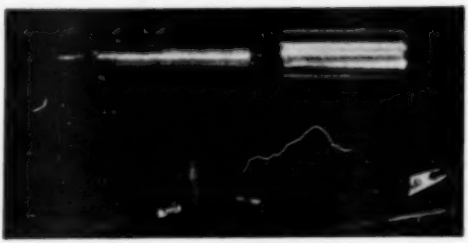

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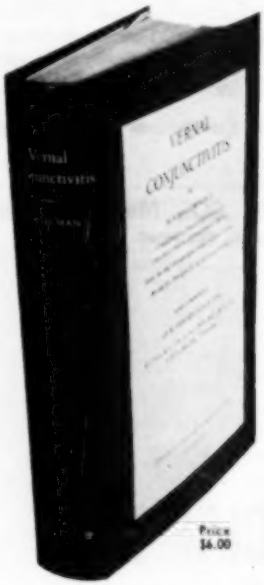

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Clinical Professor of Surgery (Ophthalmology), University of Southern California School of Medicine
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	12:00 to 2:00	Luncheon and Round Table Discussion on Glaucoma.
Saturday	9:00 to 12:00	Symposium on Recent Advances in Ocular Therapeutics Moderator, Dr. Derrick Vail.
	12:00 to 2:00	Luncheon and Round Table Discussion on Ocular Therapeutics.
	2:00	Ocular Injuries—Dr. Robert Masters (Indianapolis) Dacryocystitis of Infancy—Dr. J. V. Cassady
	6:00 P.M.	Banquet—Edgewater Beach Hotel
	8:30 P.M.	Seventh Annual Sanford R. Gifford Lecture: "The Present Status of the Adreno-Cortical Hormone in Ophthalmology." Dr. Alan C. Woods, Baltimore, Maryland.

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Plate 2. Gonioscopic observations during the evolution of an acute iridocyclitis. Figure 1. Sketched on April 7th. Figure 2. Sketched on April 14th. Figure 3. Sketched on April 28th. Figure 4. The final sketch made on June 11th. J. François ..... facing page 186

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Plate 5. The nature of inclusion bodies in trachoma. Figure 1. Prefollicular stage of trachoma. Prowazek-Halberstaedter inclusion bodies are in almost every epithelial cell. The clinical diagnosis was acute conjunctivitis. Figure 2. Positive Feulgen reaction of elementary bodies of the virus of trachoma in the cytoplasm of epithelial cells. Figure 3. Two Leber's cells with divers particles usually described as free initial bodies. From a nontrachomatous acute conjunctivitis. Figure 4. Positive Feulgen reaction of elementary bodies of the virus of trachoma in the cytoplasm of epithelial cells. The same scrapings were previously Giemsa stained and the typical Prowazek-Halberstaedter's inclusion bodies in the cells could be seen where the Feulgen-positive particles now are. Figure 5. An epithelial cell containing scattered elementary bodies of trachoma. Opposite to it is a Leber's epithelioid cell with divers particles usually described as free initial bodies. From scrapings of a conjunctiva showing trachoma prefolliculare. Henry Grossfeld ..... facing page 1831

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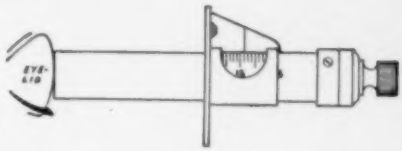

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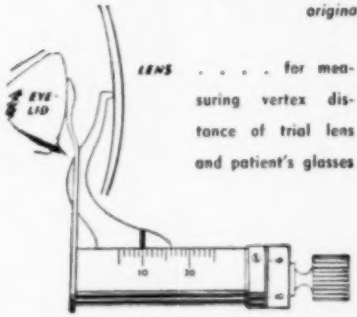

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